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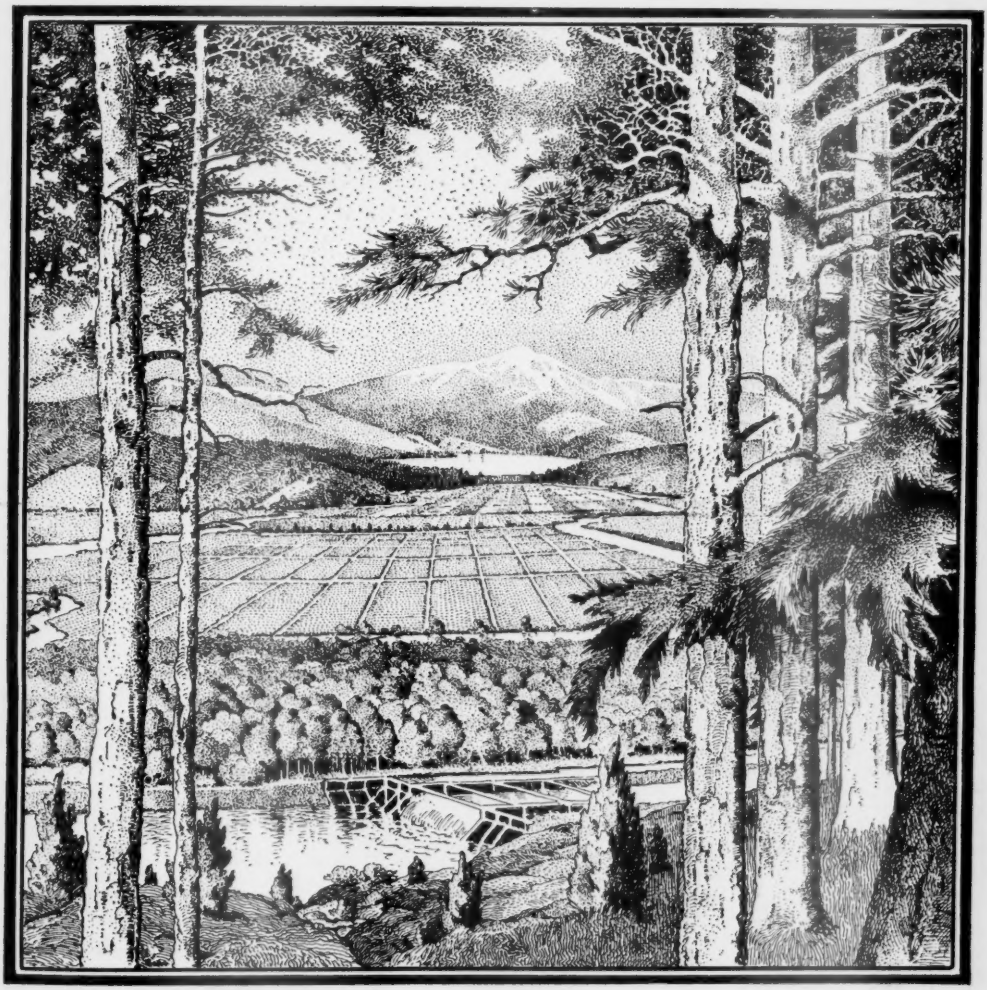
FORESTRY & IRRIGATION



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The objects of the Association, as set forth in its Constitution, are as follows:

1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.

2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.

3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.

5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural sett'ement as a remedy for the social and political evils threatened by the congestion of population in large cities.

Forestry and Irrigation

H. M. SUTER, Editor and Publisher

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GROUP OF CHESTNUT TREES ON PRIESTFORD FARM, DEER CREEK, HARFORD COUNTY, MARYLAND. THESE CHESTNUT TREES WERE GROWN FROM NUTS PLANTED IN 1822. THE LARGE TREE ON THE LEFT IS 36 INCHES IN DIAMETER. (SEE PAGE 72.)

Forestry and Irrigation.

VOL. VIII. FEBRUARY, 1902. NO. 2.

NEWS AND NOTES.

Controversy in New York. On January 23, the New York State Forest, Fish, and Game Commission gave a hearing on an application to have declared void the purchase by the State, of 30,000 acres of land in Franklin county, near Upper Saranac and Tupper Lakes, for the School of Forestry of Cornell University. This application was made by Eric P. Swenson, representing anassociation of residents and property owners of Upper Saranac Lake. Ex-Gov. Levi P. Morton, Jules S. Bache, Sidney M. Colgate, Charles Peabody, Isaac N. Seligman, F. S. Bangs, and Alfred L. White were among the signers of the petition. The association was represented by David Wilcox and John G. Agar, of New York city, and James F. Tracy, of Albany. Cornell University was represented by President J. G. Schurman, Dr. B. E. Fernow, Director of the School of Forestry, and State Civil Service Commissioner Cuthbert Pound.

The citizens' association charges that the purchase of the 30,000 acres of land is unconstitutional, and that the School of Forestry has exceeded its authority, even though the act were constitutional, by cutting down and selling the timber product of the land.

Dr. Fernow stated that his conduct of the school has been to demonstrate that the forests can be reproduced with a view to future earnings. He admitted that a contract had been entered into with a Brooklyn cooperage concern for a period of fifteen or twenty years, to utilize the timber cut from the lands. This timber was cut, he said, with a view of affording opportunity for scientific reproduction.

Lieutenant-Governor Woodruff said that the authorities of Cornell had evidently labored under a misapprehension as to what was intended when the school was authorized. He was a member of the Forest Preserve Board at the time of the purchase, and knew that Governor Black and the legislature had no intention of permitting any one to denude any part of the forests.

John G. Agar said that it is the intention of the school to practically denude the entire tract, which would be a great detriment, not only to neighboring property, but to the entire Adirondack region

David Wilcox said that the purchase of the lands was unconstitutional, because the act authorizing it had not made a specific appropriation for that purpose. The title, therefore, of the lands has never passed from the state, and they are still forest lands within the forest preserve and come within the prohibition of the constitution, that no timber shall be cut on land of that character.

Cuthbert Pound held that Cornell had simply done what the legislative act authorized it to do, and that the purchase act was constitutional.

In this connection it may be well to cite the facts leading to the establishment of the New York State College of Forestry and to the present controversy.

During the term of Governor Black the state decided that the preservation of the Adirondack forests was a necessity, and large sums were appropriated in 1897, 1898, 1899, and 1900 for the purchase of wild forest land for the forest preserve.

As a part of this policy it was decided to establish a school in which

scientific forestry should be taught. The wholesale cutting of timber on the watershed had been continued so long that it had begun to threaten the water supply of the rivers having their sources thereon. The first result of this extravagant cutting of timber was an amendment to the constitution providing for a forest preserve and to prevent the cutting of timber within its boundaries. Following that came the establishment of the School of Forestry for the purpose of reforesting lands that had been laid waste by the lumbermen.

It was in pursuance of this policy that the legislature of 1898 enacted a law to promote education in forestry, to encourage and provide for the establishment of a College of Forestry at Cornell University, and making an appropriation of $10,000 for that purpose.

Following the passage of the act a tract comprising 30,000 acres was purchased by the state in the vicinity of Tupper Lake, at a cost of $165,000, and turned over to the trustees of Cornell. To the university were given title, possession, and control of this land, to conduct such experiments in forestry as it might deem most advantageous to the interests of the state and the advancement of the science of forestry.

To the school was given the authority to plant, raise, cut, and sell timber at such times, of such species and quantities, and in such manner as it might deem best, with a view to obtaining and imparting knowledge concerning the scientific management and use of forests, their regulation and administration, the harvesting and reproduction of wood crops and earning a revenue therefrom.

At the close of the hearing it was decided that both sides would be given an opportunity to submit briefs.

Irrigation in Michigan. The reclamation of the pine barrens of Michigan by means of irrigation has been attempted at various times and successful results are announced by Mr. Alexander C. Kay, of East Tawas. He states that there are underlying waters at depths of from 50 to 70 feet, excellent in character, and which can be brought to the surface by pumping. The soil can be improved by planting in green material such as clover, cowpeas, and similar nitrogenous matter. These lands are cheap and can easily be made productive by intelligent care by enriching the soil and by providing a suitable amount of water during the period of drouth.

Rio Grande Valley. Great interest has been aroused along the Rio Grande Valley in Texas by the proposed survey for the irrigation of the valley. A bill has been introduced in Congress by Mr. Klaberg for making a comprehensive examination in coöperation with the New Mexico authorities.

New Hampshire. Keen interest in New Hampshire forests was shown at the first annual meeting of the New Hampshire Society for the Protection of Forests, held in Concord, N. H., on January 21st. Representatives were present from different parts of the state. The treasurer, Gen. George T. Cruft, was able to report a cash balance of nearly $1,500. The report of the secretary, Mr. Joseph T. Walker, of Concord, showed the beginning of an educational campaign that must sooner or later reach the legislature of the state and result in the moderate progressive action desired. Mr. Philip W. Ayres, of the New York State College of Forestry, was elected forester.

The program of the Society for the coming year includes:

1. A study of actual forest conditions throughout the state.

2. Coöperation with the State Forestry Commission in its efforts to secure conservative lumbering, and with the State Board of Agriculture in encouraging intelligent sylviculture.

3. Educational work in the public schools, women's clubs, the grange societies of the state, and similar organizations.

The officers of the preceding year were unanimously reëlected.

Railroad Buys Irrigation System. The Northern Pacific Railway, through the Northwestern Improvement Company, has purchased an extensive irrigation system in the lower Yakima Valley, Washington, comprising the Kennewick, Kiona, and Lower Yakima Canals, and a large portion of the lands underlying the same.

These properties have had a somewhat interesting history. In 1888 the Yakima Irrigating and Improvement Company was incorporated with a capital of $400,000, practically all of which was subscribed by capitalists of Buffalo and Niagara Falls. This company constructed the Kennewick Canal, then made the big mistake, which was the cause of all its subsequent misfortunes, of turning over the canal in 1893 to the Dell Haven Irrigation District, which had been incorporated under the state law, taking bonds of the district for the canal property. The management of the canal under the district organization was a failure, and after two years of spasmodic operation, further effort was abandoned and the canal has been idle ever since.

In addition to the Kennewick Canal, the company also constructed the Kiona Canal, which has been in successful operation since. It also commenced the construction of the lower Yakima Canal, but did not complete the same, and it has never been operated.

No interest was ever paid upon the district bonds, and the company having guaranteed them, they were forced into bankruptcy, a receiver appointed, and the property sold under foreclosure proceedings. It was discovered, however, that the state law did not provide any method of disincorporating an irrigation district, and this was necessary before the property could be reorganized. The last legislature enacted the necessary law, and under the same the district has been wound up and all legal entanglements straightened out.

In the meantime the eastern capitalists interested, weary of the long delay, made overtures to the Northern Pacific to purchase the property, and after some negotiations the deal was closed.

This purchase by the railway company marks a new departure in its policy. Heretofore it has preferred to

IRRIGATED FARMS IN ATANUM VALLEY, WASHINGTON.

encourage others to construct irrigation canals, and this will be its first experience in canal ownership and management. The operation of the property will be directed by Thomas Cooper, assistant to the president of the road, who is familiar with irrigation affairs, and whose policy in all land matters connected with his company has been low prices, quick sales, and speedy development.

The main Kennewick Canal is 40 miles in length, with about 10 miles of laterals, and covers about 15,000 acres. The Kiona Canal is constructed and in operation for 10 miles, covering about 2,000 acres, but will ultimately be extended to the Columbia River, a distance of about 24 miles, and will then cover about 23,000 acres. The lower Yakima Canal was partly constructed for a distance of six miles, but never operated. It will now be completed and put in operation. The lands under these different canals are of the same general character as those which have made the Yakima Valley famous for its fruit, hops, alfalfa, potatoes, and other products. The elevation being considerably lower than further up the valley, the climate is warmer and the growing season longer.—Tacoma, Washington, *News*.

Forest Reserves for Nebraska. The proposition has been laid before the President to establish three forest reserves, aggregating 558,720 acres, in the sand-hill region of Nebraska.

This region includes about one-fourth of Nebraska, and contains by far the greater part of the ten million acres of government land in that state. The proposed reserves are located in the worst part of the sand-hills, and contain but one per cent. of land held under private claim. The land is wholly unfit for agriculture, cannot be irrigated, and is of small value for grazing, 20 to 40 acres being required per head of cattle.

After a thorough investigation, the Bureau of Forestry has become fully convinced that several species of valuable pines can be so successfully and economically grown as to give the land a producing value far above its present rate as grazing land. This conclusion is substantiated both by natural conditions and experiment. Two of the proposed reserves originally were partially covered by a valuable growth of pine and cedar, and even now in places contain many young trees which need only protection to make valuable timber. In other places on the reserves there is a more or less pronounced tendency toward shrub and tree growth. Added to the favorable natural conditions are the experiments of the Bureau of Forestry, begun eleven years ago. Pines planted at that time under the worst sand-hill conditions are 15 to 20 feet high and growing with great vigor—this without the least attention except protection from fire and stock.

This is the first proposal for national forest reserves on land principally devoid of present forest cover, and involves the principle of artificial forestation. The Attorney-General has given his opinion to the effect that under the law of March 3, 1891, the President has authority to withdraw from settlement land of this character and set it aside by public proclamation in permanent forest reserves.

The forestation of the proposed reserves need not interfere with grazing except as the land is actually planted to timber. The only effect of the action will be to withdraw the land from settlement and make it available for forestation as needed. The proposal is highly favored by the people and officials of Nebraska generally. Governor Savage, who is a warm friend of forestry and irrigation, has written to the President strongly endorsing the plan. Resolutions favoring the plan were recently passed by the Nebraska Academy of Sciences and the State Horticultural Society.

Labor Unions Favor National Irrigation. At the recent convention of the American Federation of Labor, held at Scranton, Pa., the following resolution, introduced by Delegate H. White, representing the United Garment Workers, was adopted:

Whereas, In his annual message the President of the United States recom-

mends the construction of great storage works to equalize the flow of streams and to save the flood-waters, in order to irrigate and make productive vast areasof the vacant arid public lands of the West; be it

Resolved, 1. That this work in its larger features is a national and not a local or state function, inasmuch as the land to be irrigated now belongs to the nation and the proposed undertaking involves interstate relations properly subject to control bythe nation, since the great rivers of the arid regions flow through many states, the mainline irrigation canals will supply water to lands lying in different states, and the water flow concerns interests which extend to the mouths of the rivers in the Pacific and Gulf states.

From the Brooklyn *Eagle*.

THE WESTERN DESERTS AS THEY ARE AND AS THEY CAN BE TRANSFORMED.

2. That all of the public domain to be irrigated should be reserved for actual settlers of quarter sections or less under the Homestead Act, the sole principle in obtaining title to be occupancy and use.

3. That we are unalterably opposed to the cession, by sale or otherwise, of such lands to corporations or speculators or to the several state governments, and equally to the donation of the proceeds to the states, every such course having heretofore resulted in sales to monopolists, with consequent grave injuries to the rights of actual settlers and producers.

Tour through European Forests. A tour through the European forests is announced by the Biltmore Forest School, to begin April 10 and to end July 8.

The tour will begin with an excursion through the German forests. The types of silviculture as practiced in the pine, spruce, beech, oak, and coppice forests will first be studied. The Vogelsberg, the Spessart, the Black Forest, the Bavarian Mountains, and the Tyrol will then be traversed, the tour ending with a trip through Hungaria and Roumania.

Altogether this tour will be an excellent opportunity for the American forester to learn something of European methods. The cost will be comparatively low and the time consumed in making the trip will be short. Persons interested in the tour will do well to communicate with Dr. C. A. Schenck, director of the school, who writes that he will be glad to include in his party anyone wishing to make the tour.

Forests and Snow. "Forests and Snow" is the title of an interesting bulletin prepared by Prof. L. G. Carpenter and issued by the Colorado Agricultural Experiment Station at Fort Collins, Colo. It

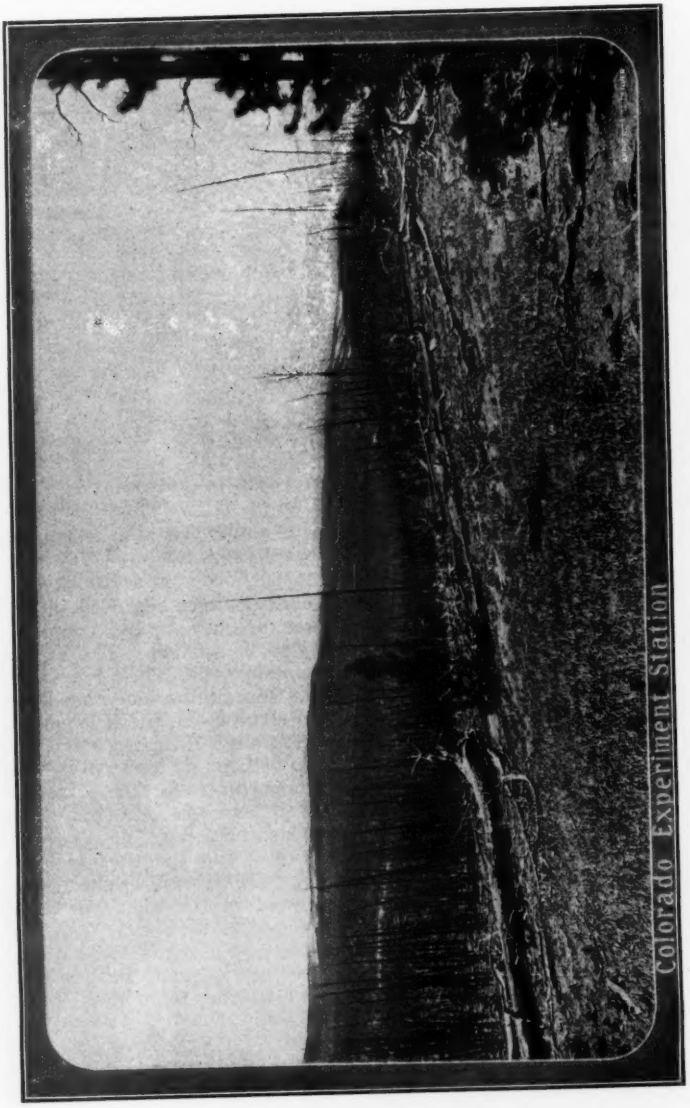


FIG. 1.—THIS VIEW SHOWS BARE SLOPES AND SNOW ALL GONE. ELEVATION 9,600 FEET. PHOTOGRAPH TAKEN AT NOON, JUNE 21.

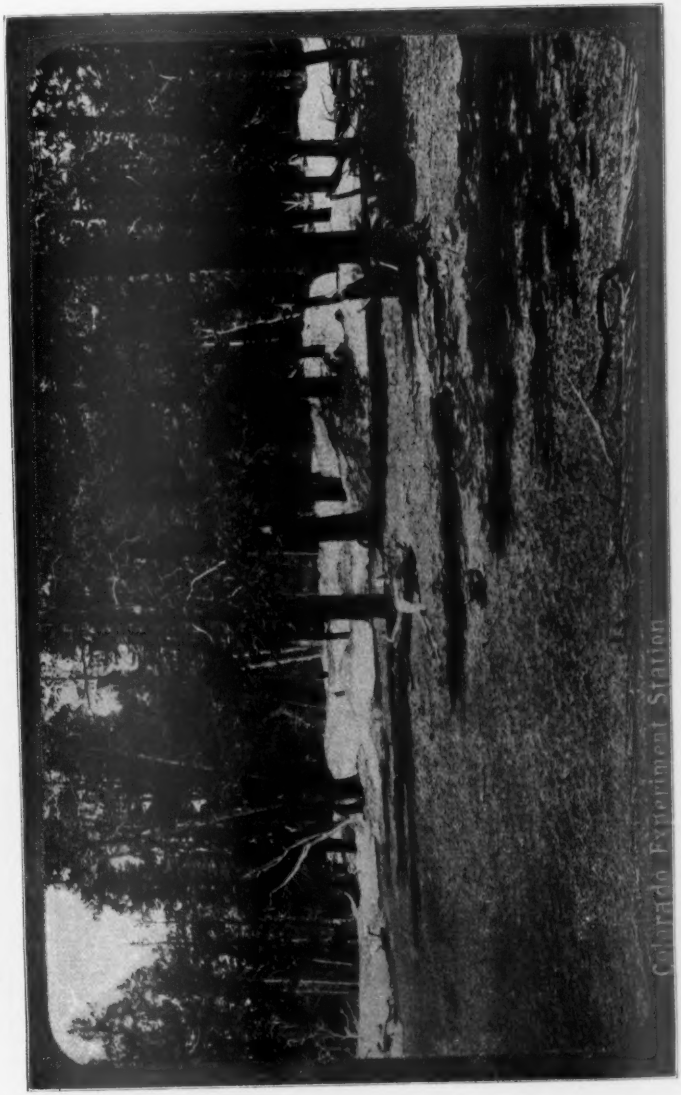


FIG. 2.—THIS ILLUSTRATION SHOWS SNOW IN GREEN TIMBER AND DEMONSTRATES THE VALUE OF FOREST COVER. PHOTOGRAPH TAKEN JUNE 21.

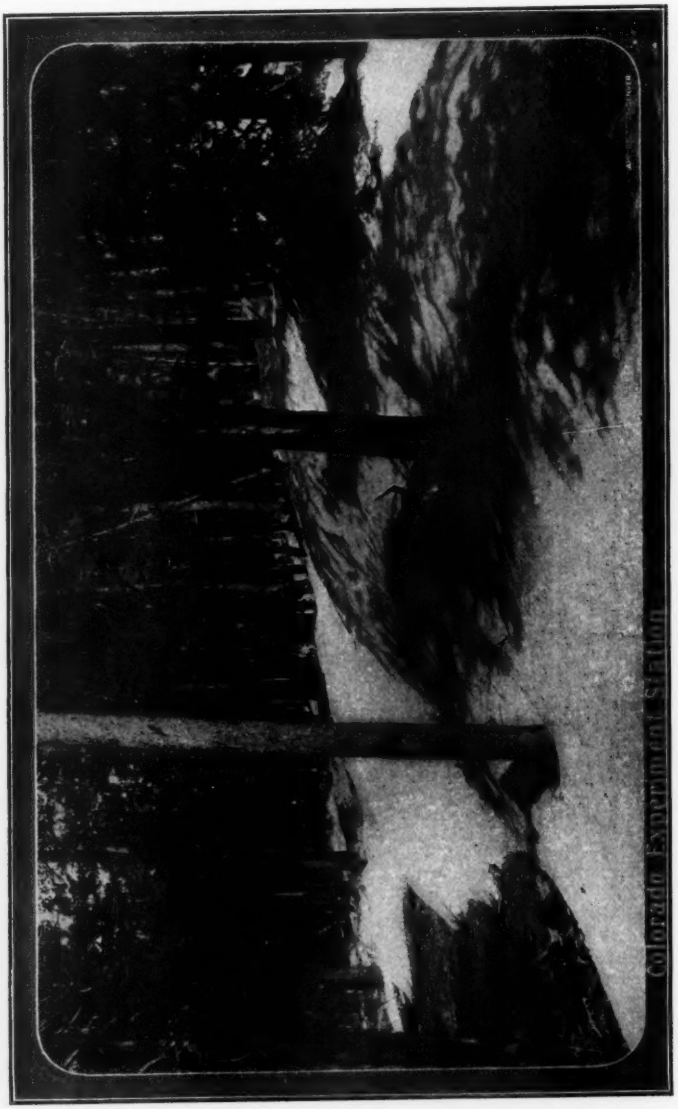


FIG. 3.—DEEP SNOW DRIFTS IN GREEN TIMBER. FARTHER IN THE FOREST THAN FIG. 2. TAKEN JUNE 21.

is intended to show "the intimate connection between the melting snow banks of the mountains and the agricultural prosperity of Colorado." The influence of forests on the melting of snows and the consequent floods or decrease of flow in the streams is carefully traced. A series of eighteen half-tone plates make the bulletin especially attractive. The accompanying plates from this bulletin are reproduced here through the courtesy of Professor Carpenter.

Sale of Public Lands. Under the proposed Newlands national irrigation bill the reclamation fund is to consist of such money as is received from the sale of public lands in the arid states, minus the expenses of administration and survey incurred by the land office.

These states and the net amount credited to each last year are as follows:

Arizona	$31,755
California	120,183
Colorado	172,548
Idaho	126,323
Kansas	7,568
Montana	377,222
Nebraska	72,116
Nevada	7,381
New Mexico	38,160
North Dakota	314,662
Oklahoma	611,773
Oregon	284,307
South Dakota	149,792
Utah	67,505
Washington	181,818
Wyoming	165,957
Total	$2,729,070

This means in plain figures that under the Newlands bill the government would have had last year nearly $3,000,000 to spend for irrigation works. It means that those advocating state control would allow Oklahoma $611,000, where irrigation is not much needed, and Nevada, where it is essential to further development, would only get $7,300, or not enough to pay for the surveys.

To Prospective Forest Students. A recent publication of the Bureau of Forestry is circular No. 23, entitled "Suggestions to Prospective Forest Students." This circular was prepared with a view of furnishing to men who are thinking of taking up forestry information as to the training required, the chances for employment, and the compensation to be expected.

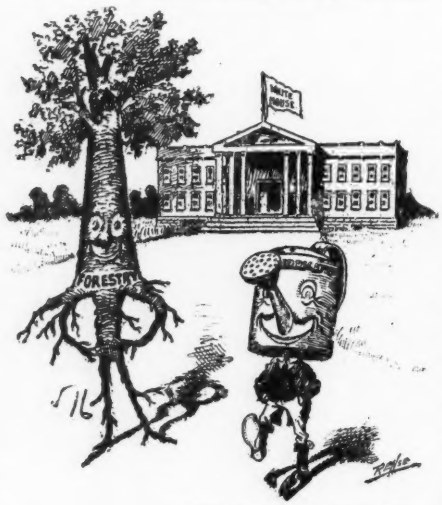
With the increase of interest in forestry throughout the country, there has come to the Bureau each year a greater number of requests for information. Last winter the Bureau in a few weeks received more than 600 applications for the position of Student Assistant, through the publication of an article in a well-known weekly paper on "Forestry, the New Profession." The writer of the article intimated that anyone desiring to become a forester need only write to the Bureau of Forestry in order to receive a position. As a result, there was a flood of applications from all sorts and conditions of men, ranging from automobile drivers to college professors. It seemed as though the populace was fired with the desire to "save the forests."

This Bureau circular will probably blast many a hope when applicants read that "the field work required of Student Assistants is severe, monotonous, and often entails some hardship. Student Assistants in the field usually live in camp and are required to keep lumbermen's hours. Their work consists chiefly in valuation surveys, or measurements of the standing timber upon given areas, and in stem analyses, or measurements of contents and rate of growth made upon felled trees.

"Cheerful obedience to orders is required of all Student Assistants. Laziness or discontent is fatal to camp discipline and to effective work. No Student Assistant is retained who proves physically unfit for his duties or who shows a desire to shirk them. Bodily soundness and endurance is absolutely essential for those who take up the work of a Student Assistant. Work in the woods differs profoundly from camp life as it is usually understood. A Student Assistant must be prepared to combine severe mental work with severe bodily labor under conditions which make each one peculiarly trying."

The circular contains a lot of valuable

information for young men who expect to take up forestry as a life work. There are plenty of warnings to expect hard work and only fair pay, and many young men will do well to fully realize this in reading the circular rather than have it thrust home while struggling over the rugged mountain sides of the far West or through the swamps of Arkansas. However, the circular is by no means filled with discouragement to beginners. There is a lot of valuable information regarding the training required, the forest schools, and chances for employment, and the young man who



From the St. Paul *Pioneer Press.*

TWO OLD FRIENDS OF THE PRESIDENT HAVE A SATISFACTORY CALL AT THE WHITE HOUSE.

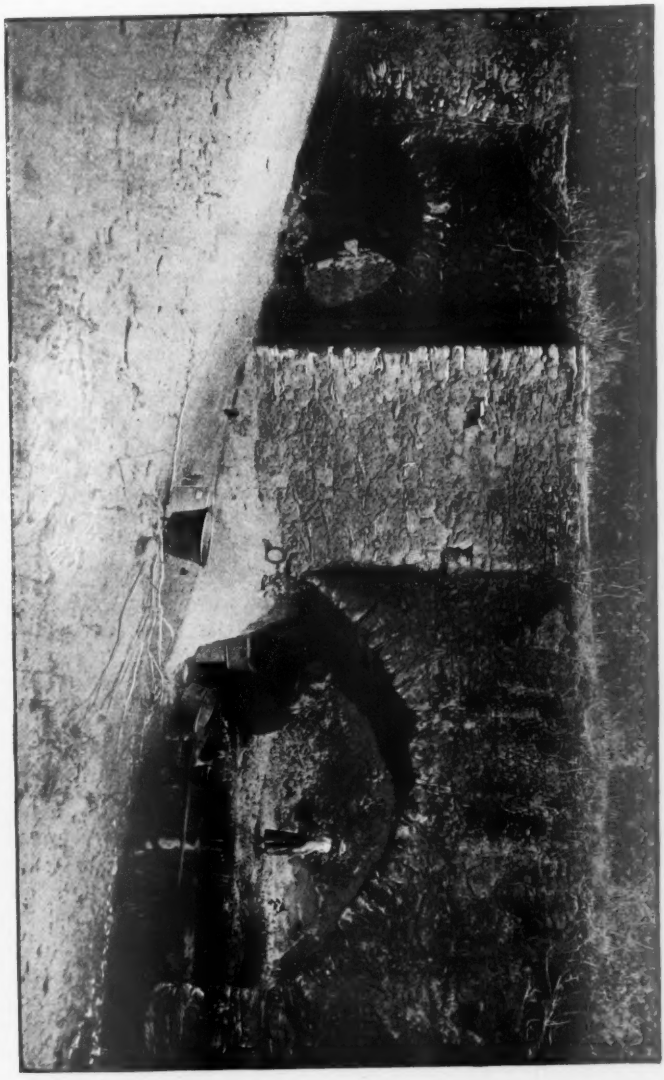
has decided that the work will be congenial will be encouraged by the following extract taken from the last page of the circular:

"The best management of the national forest reserves will require the services of many trained men. The Bureau of Forestry, in the preparation of working plans for private, state, and federal forest lands, in forest investigations, and in tree planting, is at present unable to find a sufficient number of suitably prepared foresters to supply its needs. The lack of foresters to care for the forest interests of several states is already making itself strongly felt. An increasing number of foresters will be required by private forest owners, as the great holders of timber lands come to realize more generally that conservative lumbering pays better than the methods now employed. The Forestry Bureau in the Philippines offers what is in some ways an unrivaled opportunity to trained men."

San Antonio, Texas. Attention has been attracted by the success attained on the irrigated farm of F. F. Collins, in the outskirts of San Antonio. It has furnished an object lesson to the people of that part of the state, and the experiments of Mr. Collins have put in vogue this intensive system of cultivation in west Texas. Favored by rich soil, excellent climate, and abundance of water, conditions have been created which stimulate others to undertake irrigation wherever water can be had. It is claimed that the results have been such as to double the price of every acre of vegetable land within reaching distance of the city. One of the tenants on this farm grew two crops of corn in one season, netting, it is asserted, 130 bushels to the acre. Another tenant grew Irish potatoes worth $250 per acre; sweet potatoes the same season on the same land yielded $275 per acre—a total of $525 per acre for one year. The spread of irrigation in Texas has infused new life into the state, particularly in the rice belt and in the great truck-farming sections.

Lacey Irrigation Bill. Representative John F. Lacey, of Iowa, chairman of the House Committee on Public Lands, has introduced a bill which was intended to solve the irrigation problem, so far as it confronts the present Congress.

The House Committee on Public Lands has been investigating this question for a number of years, and Mr. Lacey's idea is that some experiment should be tried before any general plans of irrigation are undertaken. He has



OLD STONE AQUEDUCT CARRYING ESPADA DITCH ACROSS PIEDRAS CREEK, SAN ANTONIO, TEXAS.

introduced a bill which is intended to try an experiment of national irrigation, as he believes that it is not likely that any general proposition can pass the House, although in the Senate the large vote from the arid states is a very important factor.

Mr. Lacey's bill proposes to authorize the Secretary of the Interior to select a tract of land not exceeding one million acres, situated in two or more states, or in a state and territory, or wholly within a territory, and to set apart the same as an "experimental national irrigation district." His idea is to make it an interstate or territorial proposition, as thereby a district would be selected that a single state could not possibly handle, because the land and water would not be both within the states controlling the work. Of course, the land in a territory would be wholly within control of the national government, and that would make it a national proposition. The Secretary, having selected the land and organized an irrigation district, would be empowered by the bill to use wide discretion in his method of reclaiming land and furnishing water supply. The land, under the bill, would be opened to homestead settlers, and the Secretary would have the right, where the land is fruit land, to reduce the size of the homestead under the ordinary 160-acre limit.

Student Assistant Seminar. The Student Assistants in the Bureau of Forestry have organized what they call "The Student Assistant Seminar." The object of the Seminar is to promote professional spirit among the students and to bring them together for the freest discussion of topics of interest in connection with forestry.

The Seminar meets every Monday afternoon at the Bureau of Forestry. The regular order of business at the meetings is the reading of minutes, the presentation of two papers, with discussions after each, the opening of the "Question Box," and the assignment of papers for future meetings.

A number of meetings have already been held, and the interest in them has increased steadily. The "Question Box" has never been empty, and its contents have furnished topics of papers for each meeting. Regular instruction, of course, cannot be given in the Bureau of Forestry, and this attempt of the Student Assistants to make the most of the good opportunity for profitable study afforded them by the Bureau shows with what earnestness they have entered upon their work.

Yale Forest Students Study Lumbering. Mr. Henry S. Graves, Director of the Yale Forest School, in December sent the entire senior class to various lumber camps in Maine and Pennsylvania. All senior lectures were discontinued for the time, and the work was transferred to the woods.

The course of instruction in lumbering in the present year's work of the Yale Forest School included a three weeks' stay in some one of the principal lumbering regions of the Northeastern States. The choice of the region to which each student should go was left to the student himself, and when the choice had been made he was provided with a letter of introduction to some lumberman in the region, and with a very complete list of questions covering the subject which he was to investigate.

Four members of the class went to Maine, and through the courtesy of Messrs. Davis and Marston (Greenville and Skowhegan, Me.) the party were allowed to stay in their camps, situated on the east shore of Moosehead Lake. An admirable opportunity was afforded to study the lumbering methods, as three of the camps were in operation and easily accessible to the party.

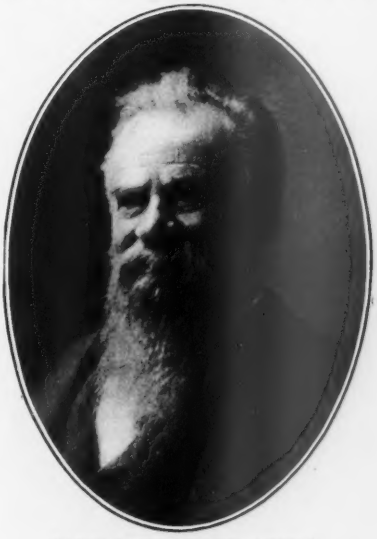
The remaining members of the class chose Clearfield County, Pa., as their field of observation, where they had a good opportunity to witness the cutting of White Pine and Hemlock on the tracts of Mr. John DuBois.

It is the purpose of Mr. Graves to make this trip of the seniors to lumber camps an annual event; it is to be just as much a part of the course as the class-room lectures.

MAJOR JOHN WESLEY POWELL.

MAJ. JOHN WESLEY POWELL is the pioneer in the scientific study of the possibilities of the reclamation of the arid region. There have been other explorers of the West who, before his time, have called attention to the opportunities for hunting, mining, and the cattle industry, but Major Powell was the first to demonstrate, from a carefully detailed consideration of the various conditions of climate and soil, that irrigation would furnish the greatest opportunities for intensive agriculture on this continent. His early work on the lands of the arid region was published as one of the volumes of the survey of the Rocky Mountain region. It attracted public attention to the lands of the arid region, which up to that time were little thought of or regarded as worthless. His book still ranks as a classic on the subject, and the ideas which he promulgated are still advocated by those who are desirous of seeing the public lands put to the largest and best use.

Major Powell was born at Mount Morris, N. Y., March 24, 1834. He graduated at the Illinois Wesleyan University, and served through the Civil War in the 2d Illinois Artillery, losing his right arm at the Battle of Shiloh. Crippled though he was, he attempted and successfully carried out the exploration of the Grand Canyon of the Colorado, which before that time had never been traversed by white men and was regarded as impassable. The result of this bold undertaking, and the scholarly manner in which the results were discussed, demonstrated his extraordinary scientific zeal and ability, and led to the formation of what was known as Powell's Survey of the Rocky Mountain Region. In 1879 he was appointed Director of the Bureau of Ethnology, and in the next year became also Director of the present Geological Survey, then in its infancy. For thirteen years, during the formative time of these two organizations, Major Powell remained at the head of both, being the active directing spirit. During all of this time he did not lose sight of the vast opportunities for the creation of homes in the arid lands of the West, and in 1888, through his continued exertions, was authorized by Congress to ascertain the extent to which the arid lands can be reclaimed by irrigation. He thus laid the foundations for the irrigation survey, the work



MAJOR JOHN WESLEY POWELL.

on which has been continued as part of the operations of the Division of Hydrography of the Geological Survey. In 1894 he resigned the Directorship of the Geological Survey, but has remained at the head of the Bureau of Ethnology. He has maintained his interest in irrigation development, and has been a friend and adviser to the men who are endeavoring to bring about the largest and best utilization of the arid region in the creation of homes.

DISEASES OF TIMBER.

By Hermann von Schrenk,
Bureau of Plant Industry.

With the awakening of interest in our forests, a number of questions are beginning to receive attention, both at the hands of the practical forester and the scientific man. One of these problems deals with the diseases of timber and timber trees. The presence of a dead tree in the forest, or the rotting of structural timber, was a matter of small moment to the past generation, for with such a large supply to draw upon, the dead trees could be ignored and the rotten bridge timber could be quickly replaced.

FIG. 1.—POLYPORUS PINICOLA GROWING ON DEAD TRUNK OF WESTERN HEMLOCK.

At the present time, however, when we no longer can count on the supply of fifty years ago, it is a matter of some concern where the great quantities of timber are to come from in the future, especially when we reflect that the railroads alone use every year 100,000,000 ties and the telegraph and telephone companies several million poles. We are not yet face to face with a timber famine, nor are we likely to be there for many years, but it behooves us to consider what is coming, for no country, however large its reserve may be, can look with impunity on the withdrawal of such amounts as indicated above without taking active steps toward conservation.

How to best conserve the existing supply is the problem with which the forestry of today has to deal. It will develop in several directions. In the first place, it will be the endeavor to establish ways and means for cutting the existing supply upon a more rational and economic basis; a second line of work will deal with the reforesting of denuded areas and the planting of treeless districts, while a third will turn its attention toward getting an increased service out of the timber after it is cut. Wood, when cut from the tree, decays in the course of time and has to be replaced. By increasing the length of life, so called, of a piece of wood, correspondingly less timber will be cut, and in that way the existing supply will be conserved.

Decay of wood, whether it be in the live tree or the dead wood, is caused by the growth in the wood of various low plants called fungi. The fruiting bodies of these fungi are the familiar toadstools, frogstools, punks, or mushrooms found on trees. The punks liberate millions of minute spores, which germinate or sprout in some old knothole, or, in the case of dead timber, on its surface and grow into the sound wood, thereby causing it to decay. When enough food has been extracted from the wood, one or more new punks form on the outside. (See Fig. 1.)

There are a great many different kinds of fungi growing on trees. Some grow only in the live parts, where they may kill the leaves, the living wood, or the roots. Fig. 2 shows the work of a destructive fungus which destroys many

young trees of the Bull and Lodgepole Pines in Idaho; others grow only in the heartwood of living trees. Such a one is shown in Fig. 3. It is the large brown punk (*Trametes pini*) found on all pines (here shown on the Shortleaf Pine—*Pinus echinata*). This fungus makes the doty wood (Fig. 4), the first stage of which is called "red heart" by timber men. It destroys enormous quantities of timber every year. Some trees are attacked more than others. Forty per cent. of the Red Fir in central Oregon is diseased because of this fungus, while the mountain pine of northern Idaho is so badly diseased that it is often impossible to find a tree entirely free from it. The spores of this fungus are blown about in the forest, and get into wounds caused by the breaking off of branches. Older trees alone are attacked, as it is only in these trees that the branch has formed heartwood.

One fungus (*Polyporus schweinitzii*) enters coniferous trees through the root. It is the cause of the "butt rot" of the older trees. The heartwood has turned into a dry, brittle mass, which may extend from one to sixty feet up the trunk. Trees affected with this disease usually break off near the ground during storms.

A distinct class of fungi grows only on dead timber. Their spores alight on the outside of a dead tree, and as the fungus grows into the wood it destroys the same. Fig. 5 shows a section of one of these trees, a Bull Pine from South Dakota, killed by fire three years ago. It will be noted that on the north side, where the bark prevented the rapid drying of the wood, one of the wood-destroying fungi entered and decayed the wood in a very short time.

The decay of railway ties, bridge and mine timbers, fence posts, etc., is caused by a number of these fungi. When placed in positions where these timbers are left moist, decay will set in from the outside. This decay makes it necessary to remove timbers frequently, involving the cost of removal as well as the cost of a new timber. When one reflects that white oak railway ties last on an average only eight years, it is easy to understand what an enormous amount of destruction these fungi do.

FIG. 2.—RUST FUNGUS ON SEEDLING BULL PINE.

One of the great problems of today is to find how one may prevent the destruction of timber by these fungi. The trees in the forest when once attacked cannot be saved. In some places where permanent lumbering operations are being carried on it will be possible to cut down all diseased trees, so as to save at least a portion of the tree. This cutting down will prevent the formation of fruiting bodies, the spores of which might infect other trees. In Germany, where systematic forestry has been carried on for many years, it is difficult to find a diseased tree at this time. As older trees are the ones usually attacked, it follows that when we once know where the danger limit begins, it will be desirable to cut all trees which reach that limit.

FIG. 3.—THE BROWN PUNK TRAMETES PINI, GROWING ON SHORTLEAF YELLOW PINE.

The decay of structural timber can be prevented for a considerable period by properly drying lumber before using it. Much is yet to be learned as to the length of time necessary to dry timber, so as to increase its length of life.

For many years engineers have endeavored to find some method for preventing this decay in structural timber by injecting various substances into the wood. These were put there to kill any fungus which had started to grow in the wood. Those most used are coal-tar oil, zinc chloride, copper sulphate, and mercuric chloride. Varying degrees of success have been obtained with these materials, depending upon the kind of timber used and the climate where the timber was exposed. We know very little as yet concerning this subject, although there is every prospect of success in this research. On some European railroads ties have been made to last thirty years and more.

It will be necessary to test all preservatives side by side under similar conditions, in order to determine which one is of the most value. An experiment has been started with this end in view in southern Texas, where the decay of timber takes place with the greatest rapidity.

When a suitable method of impregnation is found, it will be possible to increase the length of life of many timbers several times. The question is one of particular interest to the railroads, as they use such enormous quantities of timber every year. Successful impregnation will mean the utilization of inferior timbers, which no one wants now because they decay so fast, such as the Tamarack, Loblolly Pine, Lodgepole Pine, and Swamp Oak. When they are preserved, these timbers will be as serviceable as the scarcer and higher-priced timbers. This will allow of the utilization of vast amounts of timber which are now not used, and will admit of a more careful exploitation of the scarcer

FIG. 4.—SECTION OF SHORTLEAF YELLOW PINE, SHOWING THE WAY IN WHICH THE FUNGUS DESTROYS THE WOOD AND THEN GROWS OUT THROUGH AN OLD BRANCH.

kinds. Then, again, the trees which are being advocated for tie purposes, the catalpa and eucalyptus, are very soft woods. It would be very desirable to determine their resisting power to decay, and also whether it may not be possible to harden them somewhat.

At the present time we know very little concerning the rate of decay, the susceptibility of various timbers, the manner of infection of trees, as well as of those problems referred to above. A successful beginning has been made, and it is hoped that with the increased interest in the forests and their products further studies will be possible in the direction of understanding the decaying factors and how to prevent them.

FIG. 5.—BULL PINE KILLED BY FIRE, SHOWING DECAY ON THE SIDE WHERE THE BARK REMAINED ON.

NATIONAL IRRIGATION WORKS.

By Hon. Francis G. Newlands.*

WHAT is the demand of the West? It is that the West should be enabled to reclaim itself, without taxing the Federal Treasury and without inflicting any burden upon the general taxpayer, by appropriate legislation dedicating the proceeds of the sales of the public lands in the arid region to the reclamation of the arid lands, thus making the snow waters of that region, now running to waste, available for use by settlers under the Homestead Law, following the uniform policy of the country in the dedication of its public domain to the creators of homes. The settlers will restore to the reclamation fund the cost of the government works in the price of their lands, thus creating a revolving fund from the sales of public lands in that region, to be used over and over again in the construction of irrigation works until all the waters now running to waste are beneficially utilized.

Such is the bill which is recommended by the Western members of Congress, representing 13 states and 3 territories, a bill which guards against improvident expenditure by declaring that no contract for irrigation works shall be let until the moneys required for payment are in the fund, thus making the fund itself the limit of expenditure; a bill which guards against land monopoly by providing that the lands capable of irrigation shall be subject to entry only under the Homestead Law, and limiting each entry to a tract not exceeding 160 acres or less than 40 acres, leaving it to the discretion of the Secretary of the Interior, taking into consideration the climate and the fertility and productiveness of the soil, to prescribe as an entry

* Extract from speech delivered January 21, 1902.

such area of land as will reasonably support a family.

This measure does not involve a raid upon the Federal Treasury. It does not impose a burden upon the general taxpayers of the country. It simply involves the dedication of the lands of the West to the development of the West, and that has been the uniform policy of the country in the administration of its public domain.

Now, what have been the public-land states of the Union? Why, all the states except the original thirteen. Those states were, in the early days of the Republic, in possession of the great Northwest Territory, out of which five additional states were subsequently carved. What was the policy of the people at that time? Was it to prevent settlement the Northwest Territory, to prevent of entry of the public lands, to prevent the development of those states? No; it was to promote settlement and development.

The farmers of that time did not raise the cry of "competition." They were proud of their country—anxious for its development. They knew that this great northwest country would furnish homes for their children and their children's children, and its development would mean the prosperity and the glory of the country, and so they promoted by a liberal policy the settlement of Ohio, Kentucky, and other great states.

And what did we do when we acquired the great territory of the Mississippi Valley under the Louisiana purchase, out of which so many magnificent states have been created—all of them public-land states, all of them embracing an area of public land capable of cultivation, many times greater than the acreage which, under the most favorable conditions, can be reclaimed in the arid West?

The policy there was to promote settlement and development. The homestead act became the law of the country. The lands were given to settlers. Public lands were not then regarded as a pecuniary asset of the government out of which every dollar should be wrung for the public Treasury. On the contrary, they were regarded as a great trust, to be administered for the present and future generations.

Early in our land history these lands were sold, but they were sold at such reasonable prices as not to involve any burden upon the settlers. And finally the policy was evolved of dedicating the entire region to homesteads. A man by living upon the land for five years and cultivating it and making it his home could obtain title without payment, and he could secure a commutation of the homestead, as it was called, by the payment of $1.25 an acre at the end of fourteen months.

The policy of the government has been to administer this domain as a great trust for the settlement and development of this country.

The great State of Iowa, with 35,000,000 acres, equal to one-half of the total area which can by any possibility be reclaimed by irrigation, was opened up to settlement in competition with the other states. I repeat that 35,000,000 acres is one-half of the total area which can by any possibility be reclaimed in the arid West, for, while there are 600,000,000 acres of public lands in the arid region, the calculation of all the experienced and scientific men who have investigated the subject is that there is no water available for more than 70,000,000 acres, and that it will take generations to accomplish the work of reclaiming this area, thus adjusting the settlement to the pressing needs of ever-increasing population.

Iowa comprises one-half of the entire reclaimable area of the arid region, and it is watered from the heavens. This land was opened up to settlement in competition with the 13 original states, in competition with the five states that were carved out of the Northwest Territory, in competition with sister states in the South and West, and yet complaint is made because we ask this country to inaugurate an automatic system which will lead to the slow but ultimate reclamation of only double the number of acres in Iowa in a period of fifty—perhaps one hundred—years.

If the acreage in Iowa had no disastrous competitive effect upon the country, but if, as we all agree, on the con-

trary, its development led to the growth and prosperity of the country, I will ask what the acreage of Missouri, Illinois, Kansas, Nebraska, the two Dakotas, and the acreage lately entered in Oklahoma means in competition? You have opened up in Oklahoma within the last few years more land capable of being watered from the heavens than can by any possibility under this bill be reclaimed in the arid region in many years.

Let me explain the provisions of the bill which has been agreed upon by the Senators and Representatives from these sixteen states and territories, aggregating between fifty and sixty in number. They have agreed that the proceeds of the sales of public lands in these states—in the arid and semi-arid states—shall be put into a special fund in the Treasury, to be called the "Arid Land Reclamation Fund."

Then it gives the Secretary of the Interior the power to construct irrigation works and to permit entries under the Homestead Law of lands that can be irrigated from those works. It prevents him, however, from entering into any contract unless the money for its payment is in the fund. No indebtedness whatever can be contracted and no obligations can be assumed which will in any way threaten the Federal Treasury. Then it provides that settlers can enter upon these lands and occupy them in areas not exceeding 160 acres and not less than 40 acres, thus securing and dedicating that entire region to homes for the people; not for the people who now live there, but the people in the East, people in the Middle West, people in Nebraska, Iowa, Kansas, Illinois, and other states, who want to go farther West.

These lands are not appropriated for the benefit of the people there, except so far as each individual can avail himself of the act and secure a home; nor do the proceeds go the states. The proceeds of the sales of public lands in those states are dedicated and appropriated as a special fund in the Treasury for all time to do this work. The trust is to be administered as a national trust, by the national government, and the public domain is to be regarded as a unit, regardless of state lines. The purpose of the government, as the owner of the public lands, is simply to do such work as will render the waters available for the lands that can be reclaimed.

Recollect that the area of settlement is rapidly diminishing. The pressure of the population in the West for new homes and new farms is very great. You all know what happened in Oklahoma, where millions of acres of land were opened. Public notices were given, and people desirous of securing homes rushed to the boundary line in order to avail themselves of the benefit of the act. Mr. Wilson, Secretary of Agriculture, said recently in a speech: "You need have no fear that these arid lands will not be settled if water is made available. The farmers' sons of Iowa, who are now going to the British Dominion for the purpose of securing farms from the public domain, will go out into that region and settle upon it." This simply pursues the general policy of the government in making this land available for the homes of the great masses of the people.

We propose that the waters shall be put to a beneficial use by indissolubly joining the water and the land, and we insist that the government as the owner of the land has the right and the power and it is its duty to make these waters so available as to facilitate the settlers in making actual reclamation.

The snows that fall and supply the water may be in one state and the level lands that can be reclaimed may be in an adjoining state through which the waters flow. A state cannot operate outside of its own boundaries, and it will be impossible for it to treat the river as a unit and develop every one of its tributaries for the purpose of preventing the torrential floods, creating a constant flow, and securing thus the highest beneficial use of the water.

We enact into law the recognized doctrine of that entire region, that beneficial use shall be the basis, the measure, and the limit of the right to water.

I wish to show that this bill does not propose that the federal government

shall itself reclaim the lands. All that the bill provides for is that the government shall make the waters available, so that the settlers, either individually or by coöperation, can get at them, lead them over the lands, and upon them will be devolved the labor and cost of actual reclamation. That labor and cost itself is very large. The cost to the settler is not only the moneys he must expend in making the ditches and laterals on his own land and for the ditch connecting with the high-line ditch or the reservoir constructed by the government, but he is to pay, in at least ten annual installments, his proportionate part of the cost of the government work, and no title to the land entered vests in him until his proportionate part is paid as the price of the land. Thus this fund is kept as a revolving fund and the moneys in it are being constantly applied to the construction of new irrigation works.

THE FORESTS OF ALASKA.

By Dr. B. E. Fernow,

Director of the New York State College of Forestry.

IN the lately published volumes of the Harriman Alaska expedition there is to be found a curious divergence of statements or opinions regarding the forests of Alaska. The writer, who accompanied the expedition, prepared a longer article on the subject for the above publication, the conclusions of which Mr. Gannett, a few pages further on, seems to negate entirely, both as to the character and the value of both the interior and the coast forest.

Neither the writer nor Mr. Gannett had any opportunity of inspecting the interior forest. They could, therefore, only interpret second-hand information. Regarding this forest area Mr. Gannett uses the following language: "In this enormous region there *must be* an almost fabulous amount of coniferous timbers, sufficient to supply our country for half a century in case our other supplies become exhausted."

The writer, having carefully looked through the scanty references of explorers and surveyors, has not detected any evidences which could with propriety be used to make such a statement. On the contrary, the very opposite aspects of the situation impress themselves in reading the explorer's reports, and even if there were no such reports on the forest conditions, a mere study of the climatic and soil conditions would lead one to expect that the character of the growth *must be*, and the quantity is likely to be, different from those suggested in Mr Gannett's sentence. In other words, a statement is surely misleading which would make the interior of Alaska a vast forest country.

The sources of information must, to be sure, be carefully used and sifted, for the reporter, often being ignorant of woodcraft or overappreciative of comfort experienced under harassing conditions, may exuberate occasionally, or else allow his dismal feelings to lead him into depreciative statements; yet the consensus of all who have personally visited this region outside of the shores of the Yukon River supports practically the same story. It must not be forgotten that no one man has seen much of the vast interior country, and altogether a really very small part has been seen at all.

From the accounts of all explorers it appears that the interior of Alaska is in general an open pleateau, hill and mountain country, mostly moss-covered and devoid of trees, but with scattered, more or less open, groves on the lower hill slopes and ridges. In some of the valleys the trees crowd together more densely along the banks of rivers and lakes and cover the many islands in the rivers with dense thickets. In some localities the heads of the streams are surrounded by timber; Lieut. Henry

Allen reports that his camp on the Tozikakat River, "was in a grove of larger timber than any seen since leaving the Yukon;" one tree was nearly two feet in diameter, and at another place he mentions specially the possibility of bridging a river of forty feet in width by the felling of a spruce tree.

In Norton Bay, within a quarter of a mile from the sea, there are dense groves of spruce, but the height of the trees never exceeds forty feet and the diameter from six to ten inches; and along the Tavana River Lieut. Allen reports that most of the spruce ranges from three to eight inches in diameter; only here and there better development is reported.

While, therefore, considering the vast territory under discussion, there is even in these scattered groves a large amount of wood, in the aggregate it would be, indeed, a poor outlook if we were forced to contemplate the use of it for "supplying our country for half a century in case our other supplies become exhausted."

The open and stunted character of the tree growth, the trees mostly short, the timber knotted and checked by frost, with only occasionally better developed, because protected, groves, is what we would expect in a climate and soil like those of interior Alaska.

SCENE ALONG INDIAN RIVER, ALASKA, SHOWING SPRUCE TIMBER.

It is a dry climate, for, while blessed with an abundant snowfall (8 to 15 feet), the country suffers from droughty summers (rainfall, about 13 inches) and icy winters.

In summer the temperature is said sometimes to exceed 112° F. in the shade, while in winter it has been known to fall to —60° and lower, a range of 170°. On the northern and western coast there are experienced "blighting, ice-laden Siberian storms, which, though not so low in temperature as the interior blizzards, are yet by far more dangerous, on account of their humidity, to animal and vegetable life." Any student of tree life will know what to expect when it is added that "the entire face of the country is covered with a heavy growth of moss and lichens nearly as thoroughly saturated as a wet sponge, which remains soggy and cold until late in summer; and even on slopes the water drains off but slowly, while a few inches below this cover is a bed of rock, ice, or frozen

ground which thaws only for a foot or two in summer and prevents the water from sinking."

The opportunity for tree seeds to sprout are, therefore, found only rarely here and there on the better-drained slopes and on the alluvial sands of river bottoms and islands.

The absolute treelessness of the lowlands which skirt the Behring Sea and Arctic Ocean, varying from 25 to 100 miles in width, may be due to this condition of the soil alone, although here entire absence of shelter from the icy winter blasts and deficiency of summer rains, the low tundras furnishing no cause for condensation, may add to the causes.

The species which are capable of existing in these inclement conditions of the interior of Alaska, ranging across the entire continent, are the Canoe-birch, Balsam, Poplar, Aspen, and the White Spruce, the last (the same species as our eastern one) being the most important numerically and otherwise.

Locally the economic importance of these limited and poorly growing forest areas can hardly be overestimated, for not only building material but fuel are of prime importance. Already reports come that the needs of the steamers now plying in greater numbers on the Yukon threaten to exhaust the more accessible supplies along the stream in a determinable time. Fires have also begun their ravages as around Lake Lindeman, where all the timber suitable for boat-building (for prospectors) has been burned off.

In regard to the coast forests Mr. Gannett's statements are: "The timber is mainly, indeed almost entirely, Sitka Spruce. There is some hemlock at higher levels, and in the southern part a little cedar also, but these are of little commercial importance. The spruce is large and fine as judged by Eastern standards," etc.

This statement shows that two people may see the same thing and yet not see it in the same way, for both the composition and the character of the forest cover has impressed the writer very differently, and as this was his main interest he paid particular attention to its study, the result of which led him to differ from Mr. Gannett as follows:

"Excepting the more or less sporadic occurrence of the species mentioned (the Alaska Cedar, Giant Arbor Vitæ, *Pinus contorta*, *Abies lasiocarpa*, Oregon Alder, and Cottonwood), the composition is simple indeed, for the bulk is made up of a mixture of two species, the Tideland or Sitka Spruce (*Picea sitchensis*) and the *Coast* Hemlock (*Tsuga heteropleytta*), to which may be added near timber-line and farther west, on the lower levels, the interesting and beautiful, but useless, Alpine Hemlock (*Tsuga mertensiana*).

"Numerically the Coast Hemlock seems to be the most common species, forming usually from 70 to 80 per cent of the composition of the forest, the spruce only occasionally preponderating, especially along water-courses and on newly forested moraines, until the western limit of the hemlock is reached at Prince William Sound. Farther west the spruce alone continues to form forests or open groves, as on the shores of Cook Inlet and Kadiak Island, the western limit of tree growth.

"This sombre mixed forest of hemlock and spruce covers, with a more or less dense stand, the slopes of the mountainous islands and the shores of the archipelago up to timber-line, which varies from 1,800 to 2,400 feet near the shore. Toward the interior it gradually ascends with the snow-line in protected inland passes, like Taku Pass, to over 5,000 feet.

"The stand is usually not so dense as would be desirable to make the clean long boles which furnish the best logs. Indeed, while individual development reminds us occasionally of the giants of the Puget Sound country, and spruces six feet in diameter and 175 feet in height were found at Sitka; and while even as far west as Prince William Sound diameters of over five feet, with heights of 150 feet, were measured, the branchy trunks offer little inducement to the lumberman. Only in some favored situations is the growth denser, the boles less tapering, cleaner of branches, and less knotty.

"This generally undesirable develop-

ment, due to open stand, is probably caused less by climate than by soil. The soil overlying the rocks of the rugged slopes is scanty, and becomes more and more so as we go north, until finally only the muck of decayed moss and other vegetation (except on the gravel moraines of glaciers) furnishes a foothold for the trees. In consequence fallen timber frequently makes travel impossible. The underbrush and lower vegetation is often dense and luxuriant, comprising species of vaccinium, rubas, ribes, menziesia, and the spring echinopanax."

Regarding economic aspects of this forest area, which, covering the rugged islands of the Alexander Archipelago and with a belt from two to twenty miles in width along the shores as far as Cook Inlet, may be estimated at round 20,000 square miles, the writer was especially solicitous to form a sound judgment, since such variable accounts had been given of the magnificence, or else the uselessness, of these supplies. This judgment he formulated as follows:

"Leaving out of consideration the two cedars, which are found only in limited quantities and will soon be exhausted, the other two species, spruce and hemlock, are by their nature not capable of furnishing high-class lumber. The hemlock furnishes a material which would answer very well for house-furnishing purposes, but it is objected to because it is difficult to work, and enormous quantities of far superior development are now going to waste in the forests around Puget Sound because its value is not known or appreciated in the market. The spruce, being a rapidly grown, coarse-grained wood, even where it is best developed on the Oregon coast, makes indifferent timber, fit only for packing cases, boxes, and common building material, undesirable as long as better material can be had.

"In addition to the small value of these woods and of their comparatively unsatisfactory development, the conditions under which lumbering on the rugged slopes would have to be carried on are extremely difficult. That the value of this forest resource must increase with the development of the country and with the increase of local needs allows of no doubt; as a field of exploitation under present economic conditions it does not offer any inducements, unless it be that the spruce could be turned into paper pulp, the good felt-

TREES UPSET BY GLACIER, ALASKA.

ing fiber being probably insured by the rapid growth, which is found at least in the archipelago."

In other words, if wood merely were wanted the Alaska coast forest contains a prodigious supply; but if lumber of good quality, not culls, is desired, the supply is relatively small; all of which does not preclude that the time—a very distant one—may possibly come when, with the Isthmian Canal to bring them within reach, our Eastern posterity may be thankful for the poor substitute of White Pine and native spruce, a contingency which the present activity in forest matters promises to forestall.

Mr. Gannett wonders why the Island of Kadiak and the Alaskan Peninsula farther west and the Aleutian Islands are treeless. "The rainfall," he says, "is ample, the climate little more severe than at Sitka, less severe than about Prince William Sound. The suggestion that high cold winds prevent tree growth is negatived by the fact that such winds occur all along the coast in forested as well as non-forested parts."

While an explanation of this forestless condition cannot, to be sure, be established with absolute certainty, the student of plant distribution finds, nevertheless, quite plausible explanations warranted by a closer study of the situation; and in this the winds play a rôle, not because they are severe and cold but because of their direction. The Alaska Peninsula and the Aleutian Islands show evidence that they are of recent and volcanic origin. A forest could come to them only from the east or northeast, by the gradual extension of the coast forest. To secure this extension it is necessary that the winds should blow from the north and east from September to May, when the spruce and hemlock release their seed, and it should be dry in order to permit the cones to do so. The contrary usually happens: there is during these months a constant succession of southeast and south winds and the air is heavily charged with moisture. For this reason the spread of the forests is at least retarded, and only when, as may occasionally happen in many decades, when favorable wind direction at the right time coincides with a seed year, is progress possible. A most interesting example of the wandering of the spruce in recent times is found near Kadiak.

That trees can at least live much farther west than Kadiak Island is proved by a grove of spruces planted by a Russian priest many years ago at Unalaska, 500 miles to the westward. These trees, to be sure, do not show that they like the climate; and after all, if the character of the western and northern winds which strike this part of the Alaska extension were more fully studied, it would be found that they are different as regards temperature and moisture from those which have traveled over the Gulf of Alaska. Even on Kadiak Island the open groves are found only in protected coves and valleys.

AGRICULTURAL COMPETITION IMPOSSIBLE.

A POPULAR FALLACY IN CERTAIN SECTIONS OF THE COUNTRY.

THE fear of some of our eastern farmers that the development of the arid West will further reduce the value of agricultural lands and products arises from a complete misapprehension of the subject.

The great increase in farm area in the United States was from 1860 to 1890, in what is known as the North Central Division, including the States of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North and South Dakota, Nebraska, and Kansas. The improved area increased from 52,000,000 acres to 184,000,000 acres, the principal increase being in Minnesota, Iowa, the Dakotas, Nebraska, and Kansas. Over 80,000,000 acres were brought under cultivation during these thirty years in these five states alone. The population of the United States in 1870 was less than 40,000,000, or about half

what it is at present. The most extraordinary increase was from 1875 to 1885.

This wonderful increase of improved acreage in the North Central Division alone of over 130,000,000 acres in thirty years (the population of the whole United States being less than half of what it is now) has had an effect upon land values such as can never again take place. There is no other area of agricultural land comparable to that of the Mississippi Valley. In arid regions there are vast tracts which ultimately may support a larger population, but these cannot be brought under cultivation with anything like the rapidity of that practiced on the fertile prairies. Even with millions of dollars available, it will not be possible to conserve water for the arid land as rapidly as the increasing population demands new farms.

At most, water can be conserved for 60,000,000 acres, or possibly 100,000,000 acres. To do this will require one or more generations. Streams must be carefully measured year after year, reservoirs surveyed, foundations examined by diamond drill or excavation, plans and estimates prepared, contracts let and masonry structures built, tunnels dug through the solid rocks, and a thousand operations successfully performed before water can be had. Then the ditches must be dug, the laterals laid out, the ground cleared, and the soil plowed and leveled. There can be no greater contrast, as far as time is concerned, than is offered between this necessary long preliminary work and the conditions on the fertile prairies of Iowa, where men have merely to drive the plow and plant the seed.

It is now too late to speak of western competition with eastern farms. This competition and its disastrous results to the far East has long since taken place. The cultivation of the prairies of Iowa, Kansas, Nebraska, and the Dakotas revolutionized argricultural values and put them on a firm basis from which they can no longer be shaken. The Mississippi Valley now sets the standard, since the area of new land in the country which can be brought under cultivation in any one year is almost inconceivably small when compared with that now cultivated. The increase of population in the United States is from 2 to 3 per cent per year. The increase of irrigated area has been less than one-tenth of 1 per cent per year of the improved lands of the country. By the most strenuous exertions it will be impossible to increase the area of irrigated lands up to 1 per cent of the improved lands of the country, or less than one-half the rate of increase of population.

In Oklahoma, during the past few years, there have been approximately 13,000,000 acres taken up, much of this being cultivated. The rush here has brought about the most rapid development of modern times; and yet the throwing open of this land has had no perceptible effect upon farm values elsewhere. It will be impossible, under the most utopian climate, to bring under irrigation 10,000,000 acres in the same period for the reasons before stated. If, therefore, the great rush to Oklahoma, far exceeding that which can ever again be made, had no perceptible or immediate effect upon land values, how can the throwing open annually of a less amount influence the East?

It must not be supposed for a minute that because the increase of irrigated lands will be relatively so small as to be inappreciable in agricultural values their importance is correspondingly limited. While the irrigated lands have never and can never compete with the rest of the country in agricultural values, yet they afford the only remaining opportunity for the creation of homes, and they insure the highest type of agricultural and social development. The small irrigated farm, with intensive cultivation and the suburban conditions made possible under the circumstances, is the most attractive farm life, and the owners and cultivators of these farms form the most stable and substantial class of citizens; so that, although the numbers and the area may be relatively small, yet the opportunities are great.

In short, it must be confessed that the agriculturists who talk about competition are far behind the times. They have awakened only when the disastrous effects which they anticipate have become a matter of history.

TREE PLANTING IN MARYLAND.

NOTES FROM THE RECORDS OF PRIESTFORD FARM.

By Albert Neilson.

PROBABLY there is no place in Maryland where a record of tree planting has been so carefully kept for the past 80 years as at Priestford Farm, Deer Creek, Harford County, near Churchville Post-office.

The question of tree cultivation is becoming as important in Maryland as anywhere in the country. In a very short time there will be but little timber left in eastern and southern Maryland, not enough for fencing on the farms. Every farmer in Maryland with 100 acres of land could spare from one to five acres of it for tree plantations; even these small plantations of timber for fencing purposes alone will enhance the value of a farm. A very few dollars and a very little labor will plant 1,000 trees, and this number of locust and chestnut would after 15 to 20 years give the farm a continuous crop of fencing material. I venture to say that an original outlay of $100 would start two acres of such a plantation, and in some situations it could be done for half that sum.

The results at Priestford Farm have demonstrated very clearly to me that tree planting in Maryland can be made very profitable. The farm in 1822 had no timber on it of any consequence; it now has what you might term a wood lot of 40 acres, and in addition has 3,000 locust trees of various ages. All fencing material needed in the past 60 years has been produced on the farm, and the owners besides have sold many hundred of dollars worth of locust for posts and ship-building purposes.

The planting at Priestford Farm was commenced in 1822 by the writer's grandfather, the Hon. J. W. Williams, then a member of Congress, and continued by I. Crawford Neilson, the writer's father, and by the writer himself. Careful diaries have been kept all through the period.

The forty acres is termed the "House Lot," and is kept for ornamental purposes. Had my grandfather's object been the raising of trees for profit the result would have been a most decided success. The original trees were planted like an orchard, in rows and about

WHITE ASH TREE PLANTED IN 1822, DIAMETER 38 INCHES.

twenty feet apart. Since then they have been cut out and others planted, so as to get them into clumps. Several locust plantations were made, in fields outside of the "House Lot." These were cut at the proper size to make posts, and would have kept up a continuous crop, except that cattle were allowed to graze among them and all the suckers were killed. In the "House Lot" no pasturing has ever been done. The data I give with this may prove interesting to any one contemplating starting a plantation, as showing what can be accomplished with the various species of trees in a given number of years.

The first planting was done in 1822, when, on October 12 and 16, there were planted four thousand chestnuts (the

A YELLOW POPLAR PLANTED IN 1822, DIAMETER NOW 48 INCHES.

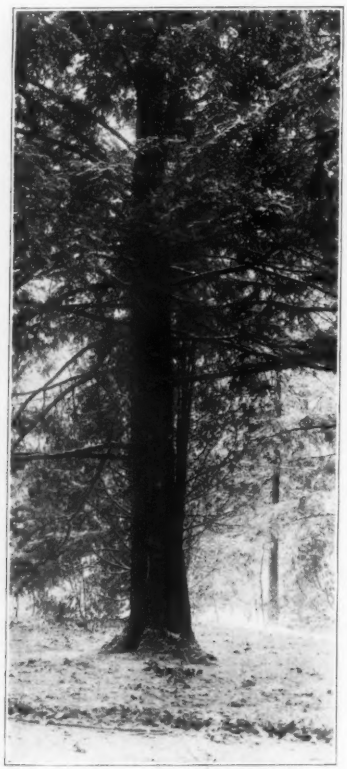
RED OAK PLANTED IN 1822, AT PRESENT 24 INCHES IN DIAMETER.

nuts). This grove has been cut over from time to time for rails, and there is now some decay. Last winter two trees from this planting made three hundred eleven-foot rails. There remain now seventy trees; forty of them are of the original planting, the remainder second and third growth. The originals average thirty inches in diameter and run up sixty feet without a limb; the other trees average fifteen inches in diameter. The trees were planted six feet apart each way, in rows.

1822.—In the spring of this year there were planted a number of Yellow Poplars, Red Oaks, White Ash, Maples, Hemlocks, and Catalpas. All but the Catalpas came from near-by woods. The result today is as follows:

Maples,	33	inches	in	diameter.
Poplars,	48	"	"	"
Hemlocks,	36	"	"	"
White Ash,	38	"	"	"
Catalpas,	30	"	"	"
Red Oaks,	24	"	"	"

April 3, 1826.—A yellow locust lane half a mile long was planted. The ground was prepared and locust seed



HEMLOCK PLANTED IN 1822, 36 INCHES IN DIAMETER.

planted. In one month the seed was up. The trees were allowed to grow for about thirty years before any cutting was done. In 1875 posts to the value of $500 were sold. Last winter it was cut clean; many of the trees were badly decayed, but the sales from them amounted to nearly $800. There were three hundred trees in all. No account was kept up to 1875 of how many posts were utilized. The second growth now stands six feet high.

The following additional notes on tree-planting are also taken from the records of Priestford Farm:

April 10, 1826.—A locust tree was planted, and when cut in 1900 was 36 inches in diameter, 110 feet high, and had a commercial value of about $30.

March 9, 1832.—A Black Walnut was planted. This tree is now 24 inches in diameter and 60 feet high. A Chestnut planted March 3, same year, is 60 inches in diameter.

November 24, 1833.—Twenty-five chestnut trees were planted. Eight now remain, averaging 24 inches in diameter and 80 feet in height. These trees were planted about six feet apart.

April 5, 1833.—Two holly trees were planted; they are at present 6 inches in diameter and 25 feet high.

February 27 to March 14, 1834.—Twenty-five hundred locust trees were planted in two plantations; the last of them were cut for posts forty years ago. They were 10 to 18 inches in diameter at the time of cutting. Cattle destroyed the second growth, as the plantations were not fenced in.

1834.—There was planted in the "House Lot" about one-half acre of locusts, 8 feet apart each way. This grove has been cut at various times and now contains much valuable timber 10 to 18 inches in diameter.

October 27, 1860.—To come to more modern times, some White Pines, found near Pennsylvania State line, were planted and are now 18 to 24 inches in diameter and 50 feet high.

1860.—Some White Ash and Black Walnut were planted. The ash are now 16 inches in diameter and the walnut 12.

October 12, 1862—There was planted a Swamp Maple 6 inches high. It is now 20 inches in diameter and 50 feet high.

1872.—Planted 350 evergreens. The White Pines are now 15 inches in diameter. The Norway Firs are 16 inches in diameter. The Hemlocks are 15 inches in diameter.

1872.—A Spanish Chestnut raised from the nut in a cigar box and planted out when 6 inches high is now 18 inches in diameter and 40 feet high.

September 23, 1875.—A Black Walnut planted this date is now 9 inches in diameter.

1876.—A locust lane half a mile long was planted. During the first four years of its life cattle damaged it to a great extent, and by 1880 nearly all the trees had been replanted. After that the cattle were kept off. There are now 260 trees, the smallest 7 inches in diameter. Two hundred and twenty-five of these trees will measure 10 to 24 inches in diameter.

1878.—Three maples were planted; now 12 inches in diameter.

1882.—Two hundred white ash trees from the woods were planted in rows under the chestnuts. They now average 3 inches in diameter and are 16 feet high. They have been growing in dense shade.

1882.—One hundred and fifty locusts planted along a fence and cut last winter, averaged 12 inches in diameter and gave five post cuts each.

1884.—Another locust lane one-half mile long was cut off in this year. The second growth was taken care of, and now the trees measure 9 inches in diameter and 40 feet in height.

1898.—A locust patch came of its own accord, covering a space of 40 by 100 feet and containing about one hundred trees. They have been kept well trimmed; average now 3 inches in diameter and 18 to 25 feet high.

FORESTRY AND IRRIGATION IN CONGRESS.

MEASURES INTRODUCED IN THE FIRST SESSION OF THE FIFTY-SEVENTH CONGRESS.

DECEMBER, 1901.

December 2.

Mr. Newlands, of Nevada, introduced a bill in the House of Representatives to authorize and begin the construction of reservoirs, canals, and other works necessary for the irrigation of arid lands in the State of Nevada; which was referred to the Committee on Irrigation of Arid Lands.

Also, a bill to provide for the disposal of the arid public lands and to authorize the construction of reservoirs for the storage of water and other necessary irrigation works for arid-land reclamation.

Rep. Reeder (Kansas) introduced a bill to authorize the construction of reservoirs, diversion canals, artesian wells, and other works necessary for the irrigation of arid and semi-arid lands of the United States.

Mr. Shafroth, of Colorado, introduced a bill to provide for the construction of storage reservoirs and other irrigation works for the reclamation of arid lands, and for the disposal of the public lands reclaimed thereby.

On the same day a bill was introduceed by Mr. Jones, of Washington, to provide pay for the improvements of actual settlers upon public lands included within forest reservations upon the relinquishment of their lands to the United States. Mr. Jones also introduced a bill amending that provision in the sundry civil act of June 6, 1900, restricting lieu selections for lands within forest reserves to surveyed land.

December 4.

Senator Pritchard, of North Carolina, introduced a bill for the purchase of a national forest reserve in the southern Appalachian Mountains; which was read twice by its title, and referred to the Committee on Forest Reservations and the Protection of Game.

Mr. Hansbrough, of North Dakota, introduced a bill in the Senate reserving, setting aside, and appropriating the receipts from the sales of public lands in the arid and semi-arid regions of the United States as a special fund, to be known as the Arid-land Reclamation Fund, for the construction of reservoirs and other necessary irrigation works for the reclamation of said lands and for other purposes; which was referred to the Committee on Public Lands.

Senator Mitchell, of Oregon, introduced a bill to appropriate funds for investigations and tests of American timber.

A joint resolution was introduced by Senator Rawlins, of Utah, directing inquiry as to the practicability of diverting the waters from the Duschense into the Provo River, of Utah, for irrigation purposes.

Senator Stewart, of Nevada, introduced a joint resolution proposing an amendment to the Constitution of the United States conferring jurisdiction on the federal courts in controversies respecting the use of water, except where the water and the use thereof are in the same state. Referred to the Committee on the Judiciary.

December 10.

Rep. Jenkins, of Wisconsin, introduced a bill to authorize and regulate the sale and use of timber on the unappropriated and unreserved public land.

December 13.

Mr. Jones, of Washington, introduced a bill in the House granting to the Yakima Irrigation Company a right of way through the Yakima Indian Reservation, in the State of Washington. To the Committee on Indian Affairs.

December 17.

Mr. Fordney, of Michigan, introduced a bill in the House amending an act relating to forest reserves, selection of land in lieu of relinquished claims in forest reservations, and national parks, and amending the act of June 4, 1897.

Rep. Moody, of North Carolina, introduced a bill for the purchase of a national forest reserve in the southern Appalachian mountains.

December 18.

Mr. Stewart, of Nevada, introduced a bill in the Senate to conserve the flood waters of Lake Tahoe in the States of California and Nevada, and to regulate the outflow thereof.

Mr. Stewart also submitted the following resolution:

Resolved, That the Secretary of the Interior be directed to furnish the Senate with such information as he may have relative to the cost of acquiring the land necessary for site and the construction of an impounding dam thereon at the source of the Truckee River, to control the surplus waters of Lake Tahoe, situated in the States of California and Nevada, and to estimate the cost of private property to be used for that purpose and the damage, if any, to private property caused by the erection of such dam; also such information as he may have as to the quantity of water that can be stored and the number of acres of land in excess of the land already irrigated which can be reclaimed by the surplus water now running to waste, and as to whether such dam would interfere with the navigation of the lake or in anywise impair the prior rights of appropriators of the waters of the Truckee River flowing from such lake.

Mr. Bowersock, of Kansas, introduced a bill to provide for the leasing for grazing purposes of vacant public domain, and reserving all rights of homestead and mineral entry, the rentals to be a special fund for irrigation.

Rep. Fordney, of Michigan, introduced a bill to repeal all provisions of the act of Congress approved June 4, 1897, entitled "An act making appropriations for sundry civil expenses of the government for the fiscal year ending June 30, 1898, and for other purposes," authorizing the relinquishment of tracts covered by claims or patents within forest reservations and the selection of other lands in lieu thereof, and for other purposes.

JANUARY, 1902.

January 6.

Rep. Bell introduced a resolution by the Chamber of Commerce of Sterling, Colo., favoring government construction of reservoirs.

January 10.

Mr. Bowersock, of Kansas, presented resolutions by the National Live Stock Association, asking for an appropriation for irrigation.

Mr. Young presented a letter by N.

O. Murphy, in regard to irrigation of arid lands.

January 15.

Mr. Gamble introduced a bill in the Senate for the relief of *bona fide* settlers in forest reserves.

January 14.

Senator Teller presented a memorial of the legislature of Colorado, remonstrating against the leasing of public lands and their cession to the various states.

January 15.

Rep. Lacey, of Iowa, introduced a bill to regulate the use of forest-reserve timber.

January 20.

In the House of Representatives, Mr. Haugen introduced a resolution by the Iowa Park and Forestry Association for the preservation of forest lands, etc. Mr. Ketcham presented a resolution by the Mount Hope Grange, No. 902, of Hackensack, N. Y., against the irrigation of any portion of the public domain at government expense.

Mr. Lacey introduced a resolution by the Iowa Park and Forestry Association in favor of a southern Appalachian National Park.

January 21.

Senator Hansbrough introduced a bill appropriating the receipts from the sale and disposal of public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands.

The bill granting to the State of North Dakota 30,000 acres of land to aid in the maintenance of a school of forestry was considered as in Committee of the Whole. It proposes to grant to the State of North Dakota 30,000 acres of the unappropriated public lands within that state to aid in the maintenance of a school of forestry, and provides that in the case of the discontinuance of the said school the lands so selected shall revert to the United States. The bill was reported to the Senate without amendment, ordered to be engrossed for a third reading, read the third time, and passed.

Mr. Newlands introduced a bill appropriating the receipts, etc. . . . (See bill introduced into the Senate by Mr. Hansbrough.)

Rep. Woods presented a petition of the California Club of San Francisco, Cal., for the purchase of the Calaveras grove of Sequoias for a national park.

January 22.

Mr. Fitzgerald introduced a resolution of the New York State Fruit Growers' Association in opposition to the proposed appropriation for the irrigation of arid lands.

January 24.

Resolution of the Pennsylvania Forestry Association, in favor of the Appalachian National Park, was introduced.

January 27.

A bill was introduced by Mr. Shallenberger to establish agricultural experiment stations in semi-arid portions of the States of North Dakota, South Dakota, Nebraska, and Kansas, and in the Territory of Oklahoma, for the purpose of demonstrating and improving a system of soil culture and conservation of natural moisture, whereby the productiveness of the lands located in the semi-arid regions of the United States may be increased without irrigation.

January 28.

Senator Millard, of Nebraska (by request), introduced the following bill: to provide for the leasing for grazing purposes of vacant public domain, and reserving all rights of homestead and mineral entry, the rentals to be a special fund for irrigation.

January 29.

Rep. Lacey, of Iowa, introduced a bill to transfer certain forest reserves to the control of the Department of Agriculture, to authorize game and fish protection in forest reserves, and for other purposes.

STANDING COMMITTEES OF SENATE.

On Agriculture and Forestry.—Messrs. Proctor (chairman), Hansbrough, Warren, Foster of Washington, Dolliver, Quarles, Quay, Bate, Money, Heitfeld, and Simmons.

On Forest Reservations and the Protection of Game.—Messrs. Burton (chairman), Depew, Perkins, Clark of Wyoming, Pritchard, Kearns, Kittredge, Morgan, Tillman, Gibson, and Simmons.

On Irrigation and Reclamation of Arid Lands. — Messrs. Simon (chairman), Warren, Stewart, Quarles, Bard, Quay, Kearns, Dietrich, Harris, Heitfeld, Bailey, Patterson, and Gibson.

HOUSE COMMITTEES.

On Agriculture.—Messrs. James W. Wadsworth, New York; E. Stevens Henry, Connecticut; William Connell, Pennsylvania; Charles F. Wright, Pennsylvania; Gilbert N. Haugen, Iowa; Herman B. Dahle, Wisconsin; Charles F. Scott, Kansas; Kittredge Haskins, Vermont; Henry C. Smith, Michigan; James M. Moody, North Carolina; J. V. Graff, Illinois; John S. Williams, Mississippi; John Lamb, Virginia; James Cooney, Missouri; Robert B. Gordon, Ohio; Henry D. Allen, Kentucky; William Neville, Nebraska; Dennis T. Flynn, Oklahoma.

Irrigation of Arid Lands.—Messrs. Thomas H. Tongue, Oregon; John J. Jenkins, Wisconsin; George W. Ray, New York; William A. Reeder, Kansas; Frank W. Mondell, Wyoming; George Sutherland, Utah; C. Q. Tirrell, Massachusetts; Francis G. Newlands, Nevada; William Neville, Nebraska; Oscar W. Underwood, Alabama; John D. Bellamy, North Carolina.

CALIFORNIA–NEVADA RESERVOIRS.

By F. H. Newell,

Hydrographer, U. S. Geological Survey.

IN the recent report of the Secretary of the Interior attention was directed to the importance of national irrigation works, and in particular reference was made to three localities where construction might be begun to advantage. These were the San Carlos reservoir in Arizona, the St. Mary reservoir and diversion canal in northern Montana, and the California-Nevada system. A

JOB'S PEAK FROM DRESSLER RESERVOIR SITE, CALIFORNIA.

brief description has already been given of two of these, viz., the Arizona and Montana works.

The boundary line between the States of Nevada and California lies on the eastern side of the high mountain range known as the Sierra Nevada, and as a consequence the streams which flow eastward head in California, receiving the greater part of their supply from the high snowy summits, such as those shown in the accompanying view of "Job's Peak." The cultivable valley lands shown in the foreground of the picture are, however, in the State of Nevada. These lower valleys are exceedingly fertile, but require irrigation.

SCENE IN MASON VALLEY NEAR WABUSKA, NEVADA, SHOWING LAND THAT CAN BE RECLAIMED BY IRRIGATION.

It is a comparatively simple matter to divert the streams coming from the mountains and irrigate these low lands, but the volume of water diminishes rapidly during the late spring and early summer, and although there is more than enough early in the year for the irrigation of all the agricultural land, yet by the shrinkage of the streams during the latter part of the crop season the fields suffer from drouth.

If the state boundary extended along the summits, or water parting, it would be comparatively easy for the people in Nevada to go up into the mountains and build reservoirs for holding the floods, restraining these until the waters are needed in the summer; but, since the reservoir sites are across the state line, they are helpless in the matter. Also the lands to be benefited belong for the most part to the government, only a small percentage of the lands of Nevada having passed into private control.

The Truckee, Carson, and Walker Rivers are the most important of the streams coming from the high mountains. The flow of these has been measured as it leaves the foothills, and systematic surveys have been begun to ascertain the location of reservoir sites and the cost of controlling the waters. It has been shown that nearly 290,000 acre-feet of water can be stored on the Truckee River system, at a cost of $356,000. The main line canals to take out this water will cost $1,150,000. The stored water supplementing the annual flow of the Truckee River will supply upwards of 170,000 acres of land.

The Carson River system embraces seven proposed reservoirs, the total approximate cost of which is $980,000, storing over 300,000 acre-feet. The final report has not yet been completed on the Carson system, and there are a number of alternatives as regards the use of various reservoirs, but it is evident that large areas can be reclaimed at reasonable cost. The character of the land to be irrigated is shown in the accompanying view of a portion of Mason Valley.

FORESTRY IN MASSACHUSETTS.

By Warren H. Manning.

THE general impression that the first settlers in Massachusetts found an impenetrable tangle of forest growth covering practically all the surface is a false one. There were extensive open areas, beaver meadows, river meadows, extensive Indian-corn fields, and open woodlands which were burned over yearly by the Indians to encourage the growth of grass for deer and to make hunting easier. These fires, under favorable conditions, destroyed the undergrowth, scarred many trees, and even destroyed the trees themselves. Certain sections burned bare of trees by such fires grew up again to dense growth after the settlement of the towns.

In the early days common land was held by the New England towns for cattle to graze upon and from which citizens were allowed to cut a certain amount of timber under restrictions. In some cases the cutting of even the rushes in the marshes, which were used for seating chairs and other purposes, was limited. These restrictions did not, however, apply to private holdings, which were stripped of timber at a very early period to clear the land for agricultural purposes; also to procure fuel for various industries, home use, and for export.

So rapidly were these woods cut that a scarcity of timber in many parts of the state is recorded between 1760 and 1800. In certain parts of the Connecticut Valley timber was too scarce to be used for fencing, and restriction was even placed on the collection of torch-wood. In the east the scarcity of timber led to the use of peat and coal for fuel.

About the year 1792 the Massachusetts Society for Promoting Agriculture, which included in its membership many of the most eminent men of the state, offered prizes for the most expeditious way of clearing land in areas of not less than twenty acres without plowing. They sent out about the same time a series of questions, among which was one asking if the growth of timber kept pace with the cutting. The answers to this question indicated that the cutting so much exceeded the natural growth that there was a serious scarcity of firewood, to which I have already referred. This led to a complete reversal of their policy, and, instead of offering prizes for the destruction of the forests, they offered prizes for forest plantations.

These prizes were continued for many years in one form or another, and resulted in forest plantations being started in various parts of the state. The trees were planted in some cases from ten to twenty feet apart. As a result of this wide spacing, the trees received so much light that the lower branches were strongly developed and a tendency established to form several leaders. Very few such plantations ever made good lumber, but where the trees were placed five to seven feet apart on suitable land, the resulting growth has been of a very satisfactory character.

In plantations made early in the century hard-wood trees, such as oaks and hickories, were used. During the second quarter White Pine was principally used. Then came a period during which plantations were made up chiefly of such foreign trees as the larches, Scotch Pine, and Norway Spruce. It was soon found, however, that they had no advantage over the native trees. During all this period comparatively little attention was given to the development of the existing growth, it being assumed then, as it is now by many, that the only forestal method worthy of consideration was the making of new plantations.

For most farmers, plantations made from average nursery-grown trees are too expensive and too uncertain. There is a section of nearly every farm that is too poor to give any return from annual crops that might be planted in forest trees with profit. Native seedling

White Pines, one-third of a foot high, from open land will transplant with almost absolute safety if enough earth can be retained on the roots when planted. White Pine will seed naturally into abandoned fields and pastures; these young pines will in places grow so thickly as to destroy each other, and so far apart in others as to make them too limby. An even stand, from four to six feet apart, should be secured by thinning out thick spots and planting open spaces.

Yearbook, 1899, U. S. Dept. of Agriculture.

WHITE PINE GROVE IN WHICH THINNING AND PRUNING HAS TAKEN PLACE, PLYMOUTH, MASSACHUSETTS.

The best time for planting is late in the spring, just before the plants push into growth, or in August, just after the new growth is well ripened. In planting, special preparation is not essential, although plants will undoubtedly do better in a plowed field. I have referred to the White Pine alone in this connection because it is generally regarded as the most reliable of our forest trees from which we can secure a profitable growth at small cost.

Where transplanting is not feasible it is probably wiser to seed and wait for a return than to go to the expense of planting nursery trees, unless the area is so large that one can secure the benefits of wholesale rates and the services of a skilful planter. The cost of seeding is quite inexpensive as compared with planting, but one must, of course, wait from three to five or six years longer to get the same result that can be secured from the collected trees. I would not have it understood that I discourage the use of nursery trees. My principal ground for objection is that we have not at present a sufficiently positive assurance of protection from fire or of an adequate financial return to justify farmers in going to any considerable expense in making such plantations. I think it is much wiser to develop the existing forest growth, where there is any, than to attempt to establish a new one.

This can be done by removing undesirable trees that are crowding more valuable specimens and by thinning at intervals to encourage a more rapid and symmetrical growth. At the present time Chestnut is probably quite as valuable, if not more so, than pine. Therefore this should be one of the trees to be encouraged at the expense of other varieties in a woodlot. In such a growth one would secure the best results if it were a pure stand of chestnut, in order that it might be cut and utilized all at one time, to give an opportunity for a uniform sprout growth to follow cutting. The ordinary Gray Birch is also a valuable tree for certain situations, and it is one of the few trees from which a good crop of cord-wood can be cut in ten or fifteen years. It will grow with White Pine and give it suitable shade and kill lower branches, without interfering seriously with its development.

At present our mixed forest growth has little or no value except for cord-wood, but even this on good land brings a substantial return; for such land will

produce one cord a year per acre up to thirty or forty years. Undoubtedly in this growth some thinning could be done to good advantage, for the purpose of producing a larger number of cords than could be secured in a densely crowded growth.

The greatest enemy to the forest owner is fire. A light fire will kill all white pine seedlings up to six or eight years of age. A severe fire will kill the White Pine up to a foot or more in diameter. A very severe fire will kill the oldest growth where it occurs in scattered patches. A hardwood sprout growth of four or five years is killed back to the stump by a light fire, a severe fire will kill a growth of fifteen years, and an older growth will be seriously injured if not killed. Furthermore, the severe fire not only kills the top but it kills the stump and burns up the top soil. Landowners fail to realize how serious this loss is. Even the State Fire Marshal, who is supposed to report all fires from which a money loss occurs, has only within the past year or two, at the earnest solicitation of the State Forestry Association, given any serious attention to this class of fire losses. His principal difficulty seems to lie in the fact that town officials who are required to make a report look upon forest fires as of little importance. Yet in some years in the country districts, it is probable that there is as great a loss in actual value from this source as from the destruction of buildings.

In general, sprout growth near towns increases in assessed value about $1.00 per acre per year of growth up to the time of cutting—that is, a fifteen-year growth is assessed at about $14.00 per acre. Now, a severe fire will destroy all this value, and the average fire at least one-half of it.

Our laws provide for a fire warden, who may employ men to fight fires and pay them twenty cents per hour. There is some evidence that forest fires have been set for the sake of securing such employment. It is known that forest fires have also been set by berry-pickers, who burn over the land for the purpose of securing a better crop the following year. Many fires are set by irresponsible hunters and ramblers in the woods. For all this there is no redress. A few convictions under the law for carelessness or malicious setting of fires will help to make people more careful, but until our public officials realize how much this loss means to forest owners it will be hard to secure such convictions.

Yearbook, 1899, U. S. Dept. of Agriculture.

PLANTATION OF WHITE PINE EIGHTEEN YEARS OLD, SOUTH ORLEANS, MASSACHUSETTS.

There is one other phase of the forest problem that may be considered a matter of sentiment on my part—that is, the preservation of fine individual trees, the

growth along roads, stream, and pond sides for shade and ornament. You, who know of the tendency of to-day, will appreciate how much land is being taken up by people from the city seeking summer homes, and also realize how much advantage it is to a community to have this class of people largely represented. You will know, too, how much such people are influenced by attractive surroundings in selecting a home. An unattractive town with no shade trees or woods stands a very poor chance of securing many such people, and the farmer who has a farm to sell that is absolutely bare, cannot hope to get as much for it as if there were some trees left in the fields, fringes of foliage along the brooks, and in the waste places. This represents the commercial value of beauty as represented by tree growth. The immediate value of this growth is represented by the wood he can secure for various farm and household purposes. To secure such wood supply it is not necessary to destroy the whole woods, as is done for the most part at the present time. By thinning out yearly, or by taking a patch of woods yearly, its beauty is not wholly destroyed and its usefulness is maintained.

In conclusion let me say that the state census shows that farmers and other owners of woodlots, throughout the state, have secured a return of 5 per cent on the value of their woodlots. Capitalists in many lines of business would be glad to secure such a return. With proper attention to the woodlots, the farmer will secure a much better showing on the right side of the ledger.

PUMPING WATER.*

THROUGHOUT a great part of the arid and semi-arid region there are localities where water can be obtained at a short distance from the surface. The amount, although not large in the aggregate when compared with the quantity in some notable stream or lake, is yet inexhaustible by the ordinary methods of pumping. If, therefore, this water which exists from 10 to 50 feet beneath the surface can be cheaply raised, it will be practicable to utilize it for agriculture tracts which otherwise have little or no value.

The irrigation of 20 acres in the midst of a section or township of land is, figuratively speaking, a mere drop in the bucket; but the reclamation of this small area generally means the utilization of adjoining lands. If, for example, 20 acres of some forage crop like alfalfa is made possible, this will result in obtaining a considerable amount of winter feed used in the sustenance of a herd which can be pastured upon the surrounding dry land. The successful cultivation of this 20 acres may thus directly or indirectly support a family, and, with increased experience and adaptation to the surrounding conditions, the family may in turn give place to a rural community. Given the existence of sufficient water underground to irrigate the 20 acres, the first question is that of ways and means of bringing the water to the surface.

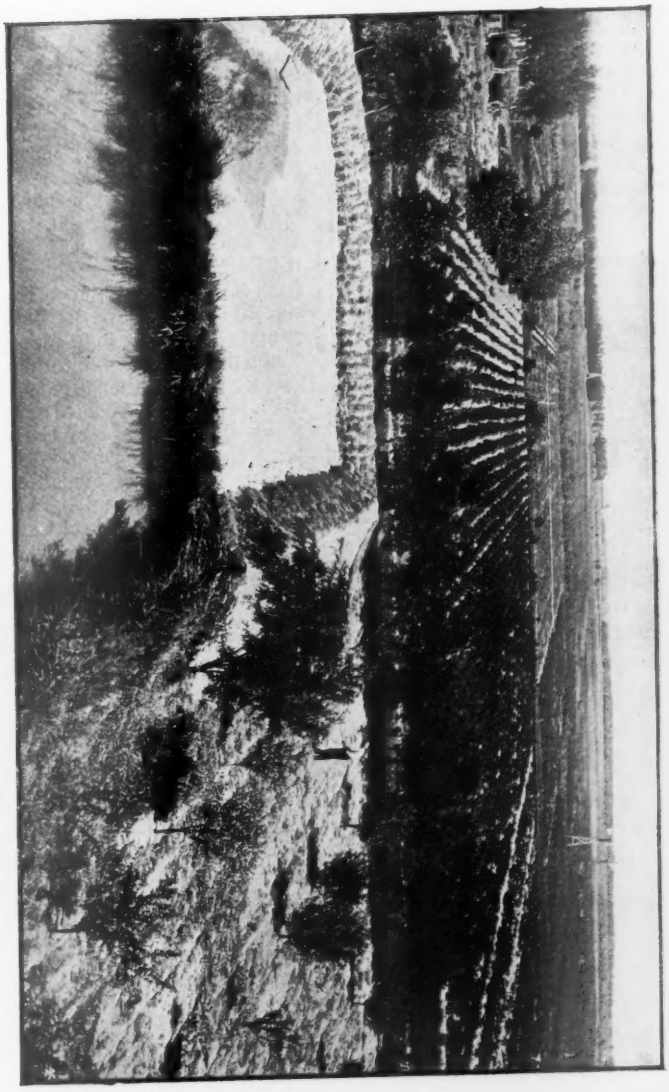
The force which is ever present, making itself persistently felt throughout the Great Plains region, is the wind, which blows almost continuously. It carries the dust before it, cuts out the traveled roads, carries away the fine earth of the tilled fields, and builds up a fine loess, almost everywhere to be found. The wind, which has so long been considered as an annoyance and mischief-maker, has sufficient strength to perform the work of bringing water to the surface, if only suitable means of directing its energy can be discovered.

The windmill is the best-known method of converting wind energy into work. In one form or another it has been used from times antedating the dark ages. In the twelfth century wind-

* EDITOR'S NOTE.—This is the second of a series of articles on pumping water. If persons interested in this subject desire further information on the topics discussed here will address queries to the Editor, they will be answered in the next issue of this magazine.

DUTCH WINDMILL AT LAWRENCE, KANSAS.

mills, built either by individvals or by communities, were common. Some of these mills were of enormous size. In the German type the whole building on which the mill was placed was constructed in such a manner as to turn on a post in order to bring the sails into the wind. In the Dutch form the building was fixed, but the head of the mill could be turned into the wind. The most notable use of these early mills was in Holland, where the land was drained by pumping water from behind the dikes into the sea. In 1391 the Bishop of Utrecht, holding that the wind of the whole province belonged exclusively to him, gave to the convent at Windsheim express permission to build a windmill wherever it was thought proper. In so doing he overruled a neighboring lord, who declared that the wind in the district belonged to him. Three years later the city of Haarlem obtained leave from Albert, Count Palatine of the Rhine, to build a windmill, using the wind of the country.



RESERVOIR AND GARDEN.

The huge, clumsy windmills of European make, such as that erected at Lawrence, Kansas, shown in the accompanying plate, have within a few decades given place in this country to the light, rapidly running forms. Thousands of these have been made by various firms throughout the country. At first wood was used almost exclusively, but this is being rapidly displaced by metal, especially by thin steel plates and forgings. Although millions of dollars have been invested in the manufacture and purchase of mills, and much attention has been given to the mechanical details and the saving in weight and cost, yet comparatively little study has been bestowed upon the actual efficiency of the various forms and upon their development toward theoretical ideals.

A view of gardens cultivated by water pumped by windmills is shown in the accompanying plate. This picture has been taken from a windmill platform. In the foreground is a small reservoir, divided by a bank in the middle, so that one part may be used independently of the other. The part nearer the observer is the older; the second part is a recent addition, rendered necessary by the increase of the area cultivated. Without windmills the cultivation of the tract of country shown in this picture would be impossible. It is doubtful if a single cow could find subsistence on the area which now supports a family.

In Fig. 1 is given a section through one of these small reservoirs, showing at the bottom the puddled earth or clay that prevents the water from seeping into the adjacent ground. On this puddled earth the banks are built at a height of from 4 to 10 feet. These are usually built by plowing and scraping up the earth from the outside, the tramping of the horses and the men serving to consolidate it. When the bank has been built to the proper height it is smoothed and sodded. On the right-hand side of the figure is the pipe or wooden flume from the windmill, and on the left-hand side is shown the outlet box, which is usually built of 2-inch plank. This is closed by some simple form of wooden gate or valve, either lifted by means of a screw or hinged so as to open outward, and is held in place by the pressure of the water against it.

The square reservoir is the form usually adopted. The mills, as in the other cases, are placed on each side, pumping through short wooden flumes over the bank. These reservoirs are not only used for holding water for irrigation, but with a little care serve as ponds for raising fish.

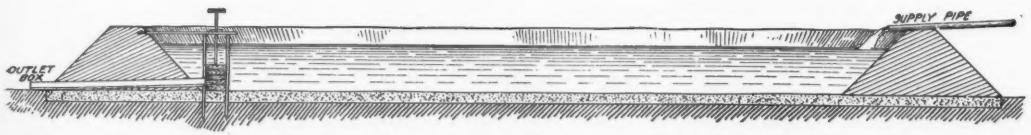


FIG. 1.—VERTICAL SECTION THROUGH RESERVOIR AND OUTLET.

RECENT PUBLICATIONS.

Studies of Trees in Winter. A Description of the Deciduous Trees of Northeastern America. By ANNIE OAKES HUNTINGTON, with an introduction by CHARLES S. SARGENT. Pp. 199. Illustrated with 11 colored plates by MARY S. MORSE, and photographs by the author. Boston: Knight and Millet, 1902. Price, $2.25 net.

This book is divided into fifteen chapters. The first deals with a study of trees in winter. Following this are chapters describing about 30 groups of well-known trees.

The restrictive portion of the title, "A Description of the Deciduous Trees of Northeastern America," unfortunately compelled the author to omit a number of very interesting cedars, spruces, firs, and pines, native and cultivated, in that region. These trees were slighted because they are evergreen.

The first chapter explains a number of technical descriptive terms and calls attention to the salient distinctive features of trees in winter. Brief mention is also made of the essential facts concerning growth and structure of trees. The remaining chapters contain notes and descriptions of 97 trees, 21 of which are exotic species common in cultivation or naturalized. The author has attempted to show that the deciduous trees chosen can be recognized in winter. The characters named are mainly the form of the tree, habit of branching, size, color, modifications of leaf buds, branchlets, color, and structure of bark. The task is well done, and with the aid of the very excellent half-tones and colored plates, the reader is rarely left in doubt. We cannot help calling attention to the beautiful picture of a superb American Elm. The talks about each tree are enlivened by poetical and historical allusions, from authors like Virgil and Cæsar down to Dr. Holmes in his "Autocrat of the Breakfast Table." The author's style is clear and pleasing, and the dry facts are made so interesting that one finds entertainment even in a book of "Studies." For the most part, technical descriptions have not been attempted. The few botanical terms used have been explained, as have also the significance of all generic and specific Latin names. The untaught, however, may halt at "subpeteolar."

The author deserves special credit for having attempted to distinguish deciduous trees in winter, a season when the layman sees the least number of characters. The trained dendrologist knows trees at all seasons; but until the distinguishing winter features are pointed out, the casual observer is wont to think of leafless trees as quite beyond identification. We believe Miss Huntington has the honor of writing the first popular tree book based on winter characters.

For completeness, we wish the author had given the geographic range uniformly for all species. We are quite satisfied to learn that

From "Studies of Trees in Winter," courtesy the Publishers, Knight & Millet, Boston.

TRUNKS OF SHAGBARK HICKORIES.

the Linden is found from New Brunswick to Georgia and west to Kansas, but disappointed in reading that the Yellowwood occurs only in Kentucky and Tennessee, or that the Bur Oak is at home on the Penobscot River, in Maine, or Lake Champlain, in Vermont, in the Berkshire Hills and on Ware River, in Massachusetts. The Slippery Elm, also, said to be "found in certain localities throughout the Atlantic States," but is "not common in eastern Massachusetts."

Occasionally the author has to rely for distinctive features on summer studies. *Prunus virginiana* and *P. pennsylvanica* are distinguished from *P. serotina* "by their red instead of black fruit." After all, we are afraid this would not be easy.

Coming to the nuts that some trees bear, it is surprising to read that "shell-barks are of greater commercial value than those of any other hickory." Doubtless the author meant to say, of any other hickories in New England; otherwise the Pecan (which is a hickory, but not of New England) would feel hurt. The nuts of *Hicoria glabra* are declared to be unmarketable; nevertheless the best forms of these nuts are sold in the market.

Speaking of the "hairy brown buds" of the Slippery Elm, the author says, "compared with the smooth hard buds on many trees, they are what soft, long-haired Angoras are to ordinary cats." In choosing this simile the author has broken down all lines of conventional description.

We commend the book as a helpful contribution to our popular literature on trees.

G. B. S.

Forest Trees and Forest Scenery. By G. FREDERICK SCHWARZ. Pp. 183. Illustrated by 26 half-tones. New York: The Grafton Press, 1901. Price, $1.50

It is not too much to say that the author has chosen a subject which is almost entirely unwritten in this country; but in giving his thoughts he has vividly expressed the feeling that is common to every true lover of the forest. By a painstaking analysis of the esthetic elements of forest scenery and its concomitants, he has presented the subject in a way that all readers may find some new beauties and economies in the habits of trees and the conformation of forests.

The author shows a careful stndy and familiarity with the trees considered. Useful facts and descriptive characters of a large number of native trees are deftly interwoven in the discussion of his subject. Excellent illustrations give a clear idea of the author's observations.

One of the most commendable features of the book is its allusions to and popular treatment, in connection with the general subject of forestry in its relation to trees and forests. This will be greatly appreciated by general readers, especially just now when the introduction of conservative forest management is receiving so much encouragement in this country. Popular interest in this subject is very great, and the book before us deserves praise for its timely hints.

A pleasing feature is the excellent printing and attractive appearance of the book. The illustrations are well chosen and clearly illustrate the points discussed.

Trees of New England. By L. L. DAME and HENRY BROOKS. Pp. 196. With plates from original drawings by ELIZABETH G. BIGELOW. Boston: Ginn & Co.

Messrs. Dame and Brooks have given the New England public, interested in our native trees, a book that has long been needed. This book is a small volume which one can easily put into the pocket and carry into the woods, and at the same time it is the best guide to the identification of our New England trees of any of the smaller books heretofore published.

Since the completion of Professor Sargent's "Silva of North America," a great many books have been written and illustrated telling about the New England trees in one way or another. These books have, for the most part, told about the esthetic side of New England tree life, often leaving a confused idea in the reader's mind of just what the species are that were written about, unless he were already familiar with them. None of these books have enabled the amateur to readily identify the New England trees in the woods or open field.

Persons interested in the woods and fond of nature do not care in particular to be told in what respects certain trees are beautiful and pleasing; they want to make these interpretations for themselves. All this sort of writing about our trees, unless it be done by a master hand, such as a Burroughs or a Muir, is not what the public wants who are accustomed to spending their summer vacations in the woods. They have long wanted a handy pocket volume enabling them to know, with reasonable accuracy, the names of the trees which they come across in their tramps through the woods during their summer vacations. They have wanted to know the names of the trees so that they can intelligently talk about them to their friends; about the various ways that the different kinds appeal to them from an esthetic standpoint, as well as in various other ways.

It seems to the reviewer that this want has been very well attained in the "Trees of New England." In this handy volume an account is given of each species naturally growing in New England, and its salient characters pointed out in a clear text and enforced by, for the most part, a clear and accurate full-page plate from a carefully executed pen drawing.

The habitat and range for each species is given with reasonable completeness, for the range of each species within New England. The habit of each species is well set forth and an account is given of the leaves, the winter buds, and the bark. A brief account is given of the inflorescence and fruit, and the horticultural value of each species is also briefly set forth.

It is unfortunate that a brief paragraph was not added to the account given of each species telling its economic value. Such information

could have been brought together by the authors with little effort and would have added greatly to the value of the book. It would have been more satisfactory to the general reader if the diameter of trees were taken breast-high rather than at variable heights on the bole. It is unfortunate that something could not have been given regarding the habit of different trees in the woods as well as in the open, for those who will use the book most are chiefly interested in the trees as a part of the forest rather than as single individuals growing in the open. A commendable feature is in the publication of the common names of the different trees actually in use in the different parts of New England.

The book is somewhat marred by the fact that the plates illustrating the species are in many cases placed with the text descriptions of other species.

J. W. T.

PUBLISHER'S NOTES.

Beginning with this number, FORESTRY AND IRRIGATION will contain a department known as "Recent Publications," in which it is our intention to review the latest books. These book notices will be prepared by competent reviewers, and we hope to make this department an interesting feature of each number of FORESTRY AND IRRIGATION. Publishers will do well to send us books on all out-door subjects; the readers of this magazine are especially interested in nature books.

Numerous inquiries have come to us concerning the kind of pumps, the cost and capacity, successfully used in procuring water for irrigation. Manufacturers and users of pumping machinery will confer a favor by sending brief statements covering these details, and particularly the results attained by pumping in different parts of the country.

We have just received a copy of J. M. Thorburn & Co.'s seed catalogue for 1902. The present issue is the one hundred and first annual catalogue published by this well-known firm; it is well printed and contains a large number of excellent half-tone illustrations of flowers and vegetables.

Three new books on forestry are reviewed this month, all of them being valuable additions to the literature on this subject. We refer to "Studies of Trees in Winter," by Annie Oakes Huntingdon, published by Knight & Millet, Boston; "Forest Trees and Forest Scenery," by G. Frederick Schwarz, issued by the Grafton Press, New York; and a "Handbook of New England Trees," by L. L. Dame and Henry Brooks, published by Ginn & Co., Boston.

Knight & Millet recently purchased the publishing business of Bradlee Whidden, Boston. The line of books on natural history formerly published by him is now being handled by Knight & Millet.

Studies of Trees In Winter

A DESCRIPTION of the DECIDUOUS TREES OF NORTHEASTERN AMERICA

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With an introduction by

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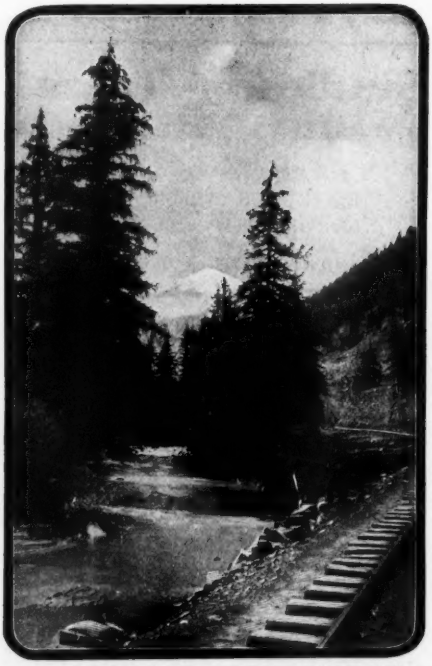

Scene in Eagle River Canyon along Denver & Rio Grande R. R.

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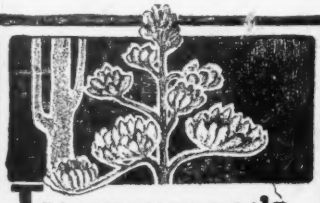

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